DISTRIBUTION OF

FERTILIZER

BY COOPERATIVES IN THE SOUTH

by Warren K. Trotter

FARMER COOPERATIVE SERVICE
U. S. DEPARTMENT OF AGRICULTURE

FCS Bulletin 11

THE Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, merchandising, product quality, costs, efficiency, financing, and membership.

The Service publishes the results of such studies, confers and advises with officials of farmer cooperatives; and works with educational agencies, cooperatives, and others in the dissemination of information relating to cooperative principles and practices.

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U. S. Department of Agriculture

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SUMMARY

THIS report is based on a personal interview survey of 31 cooperatives in 16 southern States, covering their fertilizer business during fiscal years 1950–51 through 1955–56. These associations, with their 2,795 affiliated local cooperatives and private agents, handled substantially all the fertilizer distributed cooperatively in these States.

The States covered were grouped into three areas. Area I included Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Georgia, and Alabama. Area II included Mississippi, Arkansas, Oklahoma, Texas, and Louisiana. Area III consisted of Florida only.

Objectives of the study were: (1) To provide information on the status of cooperatives in the fertilizer industry of this region; (2) to evaluate their future potential; (3) to examine the implications of economic, technological, and transportation factors; and (4) to consider the feasibility of intraregional and interregional coordination of cooperative fertilizer programs.

Major findings of this study follow:

The Place of Cooperatives

- Fertilizer used in the States covered represents about half of total United States consumption. The proportion declined slightly in the period covered by the study due to some decline in fertilizer consumption in the South and an increase in consumption in other parts of the country.
- While total consumption in the South declined about 4 percent between the fiscal year ended June 30, 1951, and that ended June 30, 1956, cooperative volume in this region increased 35 percent during that period. Cooperatives in Area III showed a 60 percent increase in volume compared to a 32 percent increase in each of the other areas. Cooperatives handling fertilizer in the South were generally in a strong economic position.
- Cooperatives supplied about 13 percent of all fertilizer used in the South for the 1955–56 fiscal year. This varied from approximately 10 percent in Area I to 24 percent in Area II.
- The share of the market supplied by cooperatives was 9 percent in fiscal 1950–51 and 13 percent in fiscal 1955–56.

Trends in Distribution

● Mixed fertilizers made up 61 percent of cooperative volume for fiscal year 1955–56, and separate materials made up 39 percent. In industrywide tonnage, mixtures made up 74 percent and materials 26 percent.

● With both cooperative and industrywide tonnage, mixtures accounted for a slightly increasing proportion of the total in the more recent years.

● Cooperatives had less seasonality in their distribution pattern than the industry in general. Thirty-four percent of cooperative tonnage was fall volume compared to only 23 percent of industrywide tonnage in 1955–56. For the industry as a whole, there was a slight increase in seasonality of fertilizer distribution.

● All fertilizer distributed by cooperatives (including both mixtures and separate materials) averaged about 29 units of plant nutrients per ton. Plant nutrient content of all fertilizer increased at a faster rate than it did for mixed fertilizer alone, primarily because of the increased use of high-analysis nitrogen materials for direct application. Nitrogen content of all fertilizer averaged about 6 units in fiscal 1950–51 compared to 13 units in fiscal 1955–56.

Mixed Fertilizer

● The number of different grades of mixed fertilizers handled by cooperatives nearly doubled during the period covered by this study—from 90 in fiscal 1950–51 to 165 in fiscal 1955–56. Each association handled an average of 19 grades in 1955–56 compared to only 13 in 1950–51.

● N–P–K grades made up 89 percent of cooperative mixed fertilizer tonnage and 92 percent of industrywide tonnage. P–K grades were second in importance, accounting for 10 percent of cooperative tonnage and 5 percent of industrywide tonnage.

● Mixed fertilizer distributed by cooperatives contained an average of about 2 units more of plant nutrients per ton than did industrywide tonnage in the South—26.3 units compared to 24.4 units. The comparable industrywide national figure was 28.6 units in 1955–56.

● Plant food content of cooperative mixed fertilizer increased from 22.2 units to 26.3 units between fiscal 1950–51 and fiscal 1955–56. This compared with an industrywide increase for the South of from 21.5 units to 24.4 units. Nationally, the increase was from 24.1 units to 28.6 units.

Separate Materials

● The composition of separate materials distributed by cooperatives between 1950–51 and 1955–56 showed a marked shift. Phosphate materials declined sharply in importance while nitrogen materials increased in importance.

● High-analysis materials such as anhydrous ammonia, ammonium nitrate, concentrated superphosphate, calcium metaphosphate, and 60 percent potash increased in relative importance for direct application. At the same time, lower-analysis materials such as sodium nitrate, ammonium sulphate, nor-

mal superphosphate, and 50 percent potash showed a decline in importance.

● Cooperatives distributed 44,000 tons of liquid and gaseous nitrogen during the 1955–56 season. This volume was distributed by eight associations through 110 retail outlets and was a 10-fold increase over the 1950–51 season. Ninety-seven percent of this was anhydrous ammonia and the remainder was nitrogen solution. Cooperatives in Area II had an important part of their fertilizer program in liquid distribution.

Merchandising Practices

● Two-thirds of the associations surveyed priced fertilizer on a delivered basis with one price for their entire territory. Nine associations used an f. o. b. plant basis for pricing; three, a zone delivered basis; and one, an f. o. b. basing point basis.

● Only 4 of 18 associations doing credit business charged extra for this service. Nine associations reported doing only cash business in fertilizer.

● About half the cooperatives covered in this study offered off-season discounts to encourage movement of fertilizer out of their plants ahead of the rush season. These programs varied from 3 to 6 months in length during the fall and winter months. The amount of the discount was reduced monthly as the regular season approached.

● Patronage refunds declared on fertilizer amounted to $5 million or 7.7 percent of total dollar volume in fiscal 1955–56. The percentage varied from 4.4 in Area I to 12.4 in Area II. The high figure for Area II was largely the result of one association's outstanding record.

Delivery Practices

● Eighty-one percent of cooperative fertilizer tonnage was moved out of cooperative plants or warehouses by trucks. This reflected a rather widespread shift to trucks in the more recent years which occurred largely as a result of increases in rail freight rates.

● Cooperatively owned trucks moved 46 percent of total tonnage in 1955–56. This was equally divided between the associations' own trucks and other cooperatives' trucks—mostly those of local retail associations. Another 29 percent of the volume was moved by contract or common carrier trucks, and farmer patrons transported 25 percent in their own trucks.

● The average distance fertilizer was delivered by truck was 54 miles. Delivery distances were shortest in Area III, averaging 27 miles, and longest in Area II, where they averaged 97 miles.

● Bulk sales made up only a small part of total volume in Area I and Area II but accounted for an estimated 50 percent in Area III.

● Bulk spreading services for fertilizer were quite generally available throughout the South. If such service was not provided cooperatively, it was usually available from custom spreaders. Two-thirds of the associations surveyed indicated that this service was available at one or more of their outlets. The service was available at 286, or 10 percent, of the 2,795 retail outlets used by the cooperatives studied.

Distribution of Fertilizer by Cooperatives in the South

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SOUTHERN farmers are traditionally heavy users of fertilizer. In recent years they have consumed around 50 percent of all fertilizer used in the United States, spending over $549 million for it in 1956.

To help reduce fertilizer costs and provide other needed services, farmers of this region have established their own systems for fertilizer procurement and distribution. During the 1955–56 season, local retail cooperatives supplied over $85.5 million worth of fertilizer to farmers of the area. This was equal to 32.7 percent of the total fertilizer business of the 4,000 cooperatives engaged in retail distribution of fertilizer in the Nation.

Purpose and Method of Study

THE fertilizer industry is undergoing many changes as illustrated by the trend toward high-analysis fertilizers, granulation, use of anhydrous ammonia and nitrogen solutions, bulk delivery and spreading, bulk blending, multi-hopper spreaders, nitric phosphates, and other changes. In recent years freight rates have advanced sharply and transportation costs have accounted for an increasingly larger proportion of the farmer's fertilizer dollar.

Such developments have created a need for information to assist farmer cooperatives and other fertilizer manufacturers in evaluating the effect of these changes on their present operations and their future location and development of facilities. There is also interest in establishment of joint programs for manufacturing nitrogen and phos-

phate, as well as further integration or coordination of the procurement function.

More specifically, the objectives of this study were:

1. To ascertain the present status of cooperatives in the fertilizer industry of the South;
2. To evaluate the potential for future cooperative manufacture and distribution of fertilizer in this region;
3. To examine the implications of economic, technological, and transportation factors on the future development of cooperative manufacturing and distributing facilities in the region; and
4. To consider the feasibility of, and the problems involved in, intraregional and interregional coordination of cooperative fertilizer procurement, manufacture, and distribution.

Information for this study was obtained by personal interviews with officials of 31 cooperatives in the southern States distributing fertilizer mixtures and separate materials. The cooperatives covered were believed to account for substantially all the fertilizer distributed cooperatively in this region.

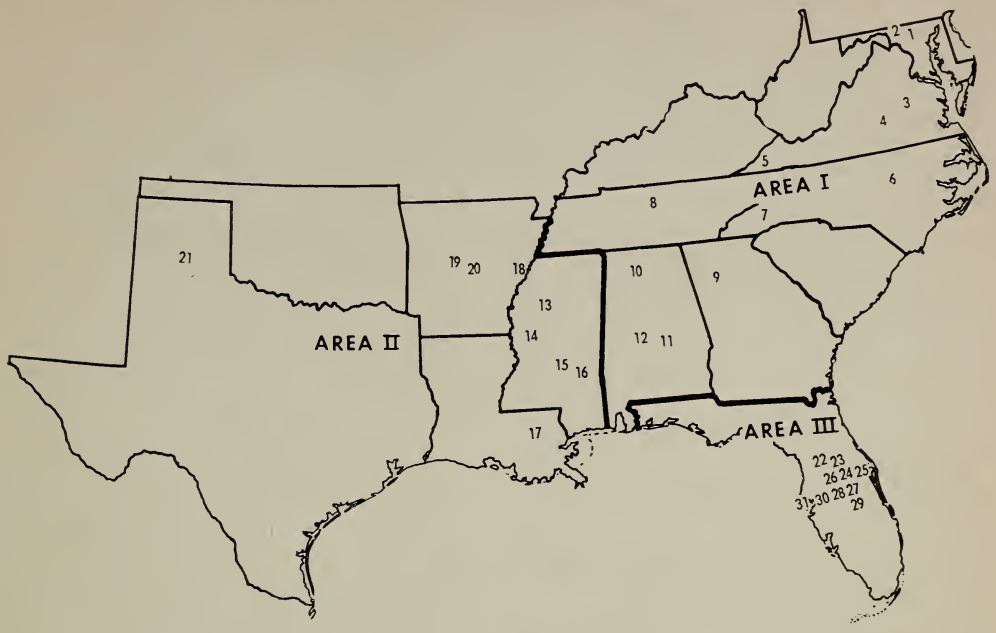
For purposes of this study the southern region was divided into three areas illustrated in figure 1. An attempt was made to delineate these areas on the basis of current fertilizer use practices. For example, grades and types of fertilizer used in Area III (Florida) varied considerably from those used in other southern States. Hence, data for this area were analyzed separately. Of the 31 associations, 12 were in Area I, 9 in Area II, and 10 in Area III.

The study will be published in two parts. The present report covers cooperative fertilizer distribution in the South. The next report will deal with cooperative fertilizer manufacturing programs in this region, giving special emphasis to transportation problems and possibilities for further coordination and integration of operations. This second report will be published later.

Adjustments have been made in the basic data to eliminate duplication resulting from business between cooperatives.

Growers Fertilizer Cooperative, Lake Alfred, Fla., contracts with an outside firm for bulk handling and distribution of its fertilizer to farmer-members. This fleet of trucks and trailers does the job.

Figure 1.—Headquarters locations of cooperatives studied, by areas



Area I:

1. Farmers Cooperative Association, Inc., Frederick, Md.
2. Chewsville Cooperative Association, Inc., Chewsville, Md.
3. Southern States Cooperative, Inc., Richmond, Va.
4. Farmers Cooperative Fertilizer Purchasers, Inc., Kenbridge, Va.
5. Southwest Virginia Cooperative, Inc., Bristol, Va.[1]
6. Farmers Cooperative Exchange, Inc., Raleigh, N. C.
7. Farmers Federation Cooperative, Inc., Asheville, N. C.
8. Tennessee Farmers Cooperative, La Vergne, Tenn.
9. The Cotton Producers Association, Atlanta, Ga.
10. Tennessee Valley Cooperative, Decatur, Ala.
11. Farmers Marketing and Exchange Association, Montgomery, Ala.
12. Centrala Farmers Co-op, Inc., Selma, Ala.

Area II:

13. Staple Cotton Cooperative Association, Greenwood, Miss.
14. Mississippi Chemical Corporation, Yazoo City, Miss.
15. Mississippi Federated Cooperatives (AAL), Jackson, Miss.
16. Magee Cooperative (AAL), Magee, Miss.
17. Louisiana Agricultural Cooperative, Inc., Baton Rouge, La.
18. Delta Fertilizer Company, Helena, Ark.
19. Arkansas Plant Food Company, North Little Rock, Ark.
20. Arkansas Farmers Association, North Little Rock, Ark.
21. Southern Farm Supply Association, Amarillo, Tex.

Area III:

22. Foremost Fertilizer Company, Leesburg, Fla.
23. Lake Region Packing Association, Tavares, Fla.
24. Plymouth Citrus Growers Association, Plymouth, Fla.
25. Fosgate Citrus Concentrate Cooperative, Orlando, Fla.
26. South Lake Apopka Citrus Growers Association, Oakland, Fla.
27. Haines City Citrus Growers Association, Haines City, Fla.
28. Growers Fertilizer Cooperative, Lake Alfred, Fla.
29. Waverly Growers' Cooperative, Waverly, Fla.
30. Superior Fertilizer and Chemical Company, Tampa, Fla.
31. Pinellas Growers Association, Clearwater, Fla.

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[1] Facilities of this cooperative were purchased by Southern States Cooperative, Inc., Richmond, Va., in 1957.

Cooperative Distribution Systems

THIS section deals with (1) early development of cooperative fertilizer distribution systems, (2) the importance of fertilizer business and (3) types of distribution systems.

Early Development

Cooperatives first began handling fertilizer in the South shortly after World War I. Farmers Federation Cooperative at Asheville, N. C., was the first, beginning its distribution of plant food in 1920. Following closely were the Louisiana Agricultural Cooperative, Baton Rouge, and Mississippi Federated Cooperatives, Jackson, in 1922, and Centrala Farmers Cooperative, Inc., at Selma, Ala., in 1923. The periods of most rapid growth of cooperatives in the fertilizer business were the depression of the 1930's and immediately after World War II. The periods when the 31 associations covered in this study began handling fertilizer were as follows:

Year	*Number of cooperatives*
1916–20	1
1921–25	4
1926–30	4
1931–35	7
1936–40	4
1941–45	2
1946–50	7
1951–55	2
Total	31

Sources of supplies for the early cooperatives were generally other business firms. At one time there was considerable discrimination on the part of suppliers against cooperatives. Therefore, it was not long before cooperatives began manufacturing their own mixed fertilizers. The first sources of supplies, by types, for the 31 cooperatives covered in this study were as follows:

First source of supply	*Number of cooperatives*
Other cooperatives	4
Other fertilizer companies	12
Own manufacturing plants	14
Tennessee Valley Authority	1
Total	31

Importance of Fertilizer Business

The volume of fertilizer business of cooperatives covered in this study amounted to more than $65 million in fiscal year 1956 (table 1).[1] This represented about 19 percent of total cooperative business in the South. The proportion fertilizer volume was of total cooperative business varied from about 18 percent in Area I to 28 percent in Area III.

Sales of fertilizer were about $41 million, or 16 percent of total cooperative business, in 1951; hence volume in 1956 was up more than 50 percent. The largest proportional increase was in Area II where cooperative fertilizer volume jumped from $12 million, or 12 percent of total sales in 1951, to $26 million, or nearly 20 percent of the total in 1956.

Types of Distribution Systems

Included in the study were both regional and local cooperatives selling at wholesale and retail. The number of associations con-

[1] All annual figures in this report are based on a fiscal year ending June 30. Where books were kept on a calendar year or some other fiscal year basis, data were adjusted to the basis of a fiscal year ending June 30.

Table 1.—Fertilizer business and its proportion of gross business of 31 cooperative associations in the South, fiscal year ended June 30, 1951 and 1956

Area	1951			1956		
	Gross business	Fertilizer business	Proportion of gross	Gross business	Fertilizer business	Proportion of gross
	Thousands	*Thousands*	*Percent*	*Thousands*	*Thousands*	*Percent*
I	$143,616	$23,540	16.4	$178,270	$32,196	18.1
II	101,948	12,391	12.2	132,305	25,799	19.5
III	19,102	5,354	28.0	26,926	7,492	27.8
South	264,666	41,285	15.6	337,501	65,487	19.4

ducting specified proportions of their fertilizer business direct with farmers was as follows:

Percent of volume sold direct to farmers	*Number of cooperatives*
0	7
1–25	4
26–50	4
51–75	1
76–99	1
100	14
Total	31

These data indicated that 16 of the cooperatives sold 50 percent or more of their volume direct to farmers while 15 distributed the major portion of their volume at wholesale through retail outlets. All except 4 of the 31 associations operated mixing plants.

The number of retail outlets used by the 31 cooperatives varied from 1 to 740 (table 2). Ten of the associations were strictly local in character distributing all of their volume through one outlet. Most of those in Area III were of this type.

The 31 cooperatives used a total of 2,795 retail outlets (table 3). Of this number, 1,752 were dealer agents. These were independent retail agencies which had been given a franchise to handle cooperative products. The second most common outlet was local retail cooperatives, numbering 736. The third most important type of outlet was the cooperatives' own retail.

Table 2.—Number of retail outlets used by 31 cooperatives in three areas of the South, 1956

Number of retail outlets	Number of cooperatives			
	Area I	Area II	Area III	South
1	2	1	7	10
2 to 15	3	2	3	8
16 to 50	1	1	0	2
51 to 100	4	1	0	5
101 to 400	1	3	0	4
401 and over	1	1	0	2
Total	12	9	10	31

Table 3.—Types and number of distributive outlets of 31 cooperatives distributing fertilizer in the South, 1956

Type of outlet	Area I	Area II	Area III	South
	Number	*Number*	*Number*	*Number*
Own retail branches	105	22	11	138
Local retail cooperatives	384	341	11	736
Branch units of locals	36	17	0	53
Dealer agents	798	950	4	1, 752
Farmer agents	52	10	5	67
Other	5	44	0	49
Total	1, 380	1, 384	31	2, 795

branches numbering 138. Local associations which had only one place of business were included in this classification.

Trends in Fertilizer Distribution

THIS section focuses attention on major trends in fertilizer distribution and use and the place of cooperatives in the fertilizer industry as a whole. It covers (1) industry conditions, (2) regional use of fertilizer, (3) comparison of mixtures with separate materials, (4) trends in use of mixtures, (5) trends in use of separate materials, (6) plant nutrient content of all fertilizers, and (7) seasonal movement of mixtures and materials.

Industry Conditions

Farmers establish their own fertilizer distribution systems for reasons of price, quality, or service. Either existing prices appear too high, quality is not satisfactory, or the service is inadequate. Once the cooperative is established, the business environment in which it must operate often changes. Farmers sometime overlook the often very important service cooperatives render by providing members with the kinds of services modern farming requires.

Advantages to farmers can be based on either price, quality, or service. Price problems were reported to be extremely keen in both Areas I and II, but considerably less keen in Area III. In Areas I and II this problem was caused largely by the dealership situation. As one manager put it, "Anybody who can finance a truck load of fertilizer can become a dealer." Manufacturers gave dealerships to many farmers and truckers who often handled fertilizer for the trucking charge. This situation caused problems for the cooperative interested in preserving its distribution setup.

Area III, primarily the citrus area of Florida, had different industry and cooperative structures. Here fertilizer manufacturers, including cooperatives, for the most part sold direct to the farmer, bypassing local dealers. This had been the established practice for many years. Consequently, there was not the extensive dealership development that had occurred in other areas of the South.

Another factor in Area III tending to reduce price competition was the extent to which integration had progressed. Most cooperatives in the citrus area offered a complete grove management and caretaking service including the harvesting and marketing of fruit. Fertilizer manufacture developed as a sideline to fruit packing or processing in several instances. Sometimes the grower was required to use the association's caretaking service in order to market his fruit through the cooperative. Thus, competition in this area was based on the association's overall service rather than on fertilizer prices.

Quality and service, although important factors, were considered subordinate to price in Areas I and II. This was because quality and services offered were considered about the same for all distributors, cooperative or otherwise. Granulation was not an important competitive factor in any area of the South, although it was believed to be increasing in importance.

Regional Use of Fertilizer

Regional use of fertilizer was considered from the standpoint of (1) industrywide trends, (2) the place of cooperatives, and (3) annual changes in volume.

Industry Trends

Nearly one-half of all fertilizer materials consumed in Continental United States during the year ended June 30, 1956, was used by farmers in the 16 southern States (figure 2). Because of the rapid increase in use of fertilizer in other

Figure 2.—Commercial fertilizer use in the South as a percentage of that in the United States, year ended June 30, 1951–56

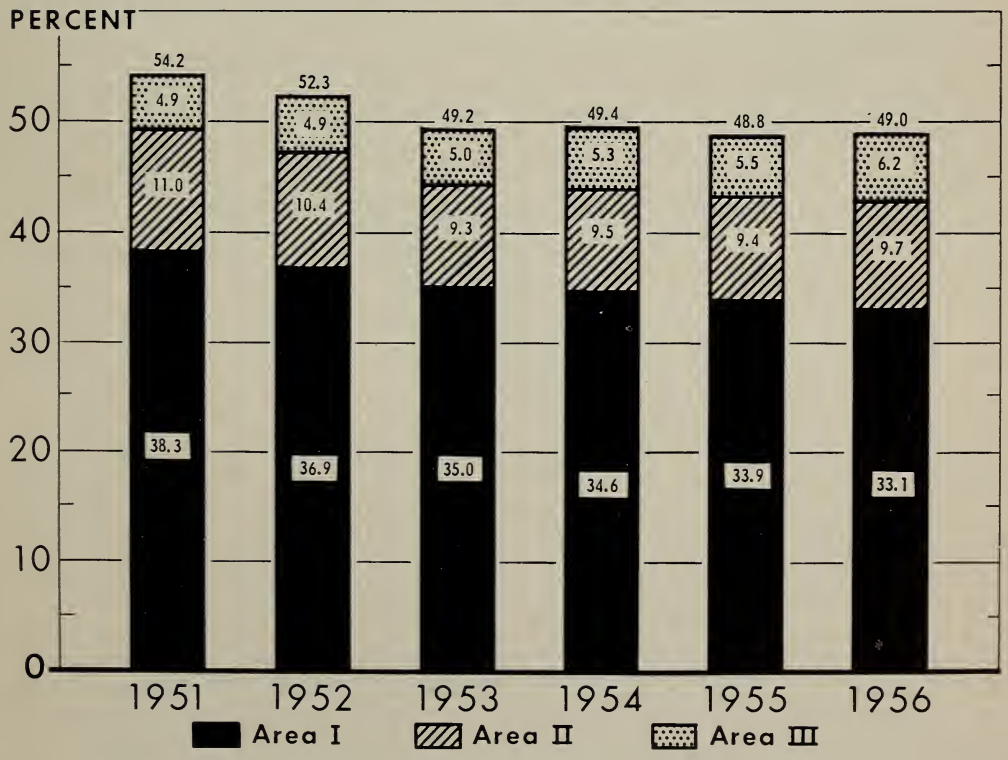


Table 4.—Cooperative fertilizer sales compared with total farmer expenditures for fertilizer in four regions of the United States, 1953–54

Region	Farmer expenditures for fertilizer [1]	Cooperative fertilizer sales [2]	Proportion sold by cooperatives
	Millions	*Millions*	*Percent*
North Atlantic	$111. 8	$31. 2	27. 9
North Central	458. 5	110. 2	24. 0
Southern	555. 2	74. 0	13. 3
Western	148. 3	16. 7	11. 3
United States	1, 273. 8	232. 1	18. 2

[1] For calendar year 1954.
[2] For calendar year 1953, or fiscal year ended June 30, 1954.

sections of the country the proportion used by southern farmers declined somewhat in more recent years—from 54 percent in 1951 to 49 percent in 1956.

The States making up Area I

Table 5.—Proportion of farmer expenditures for fertilizer represented by sales of cooperatives in the South, 1953–54

Area and State	Farmer expenditures for fertilizer	Cooperative fertilizer sales	Proportion supplied by cooperatives
Area I	*Millions*	*Millions*	*Percent*
Alabama	$52. 7	$6. 8	12. 9
Delaware	5. 2	1. 2	23. 1
Georgia	69. 8	3. 4	4. 9
Kentucky	31. 6	3. 0	9. 5
Maryland	16. 2	3. 1	19. 1
North Carolina	86. 4	4. 6	5. 3
South Carolina	41. 9	. 9	2. 1
Tennessee	25. 5	5. 8	22. 7
Virginia	39. 2	7. 7	19. 6
West Virginia	4. 2	1. 4	33. 3
Total or average Area I	372. 7	37. 9	10. 2
Area II			
Arkansas	23. 0	5. 5	23. 9
Louisiana	19. 4	2. 7	13. 9
Mississippi	42. 3	14. 4	34. 0
Oklahoma	8. 3	1. 0	12. 0
Texas	30. 9	3. 0	9. 7
Total or average Area II	123. 9	26. 6	21. 5
Area III			
Florida	58. 6	9. 6	16. 4
South: Total or average	555. 2	74. 0	13. 3

used one-third of all the fertilizer consumed in the United States. This proportion declined from 38 percent in 1951 to 33 percent in 1956. Area II also had a slight decline in its proportionate share of fertilizer while Area III increased its portion slightly.

The volume of fertilizer used in the southern States was approximately 10.7 million tons for the year ending June 30, 1956. This figure reflected a decline of about 1 million tons since the 1951–52 season when consumption was approximately 11.5 million tons.

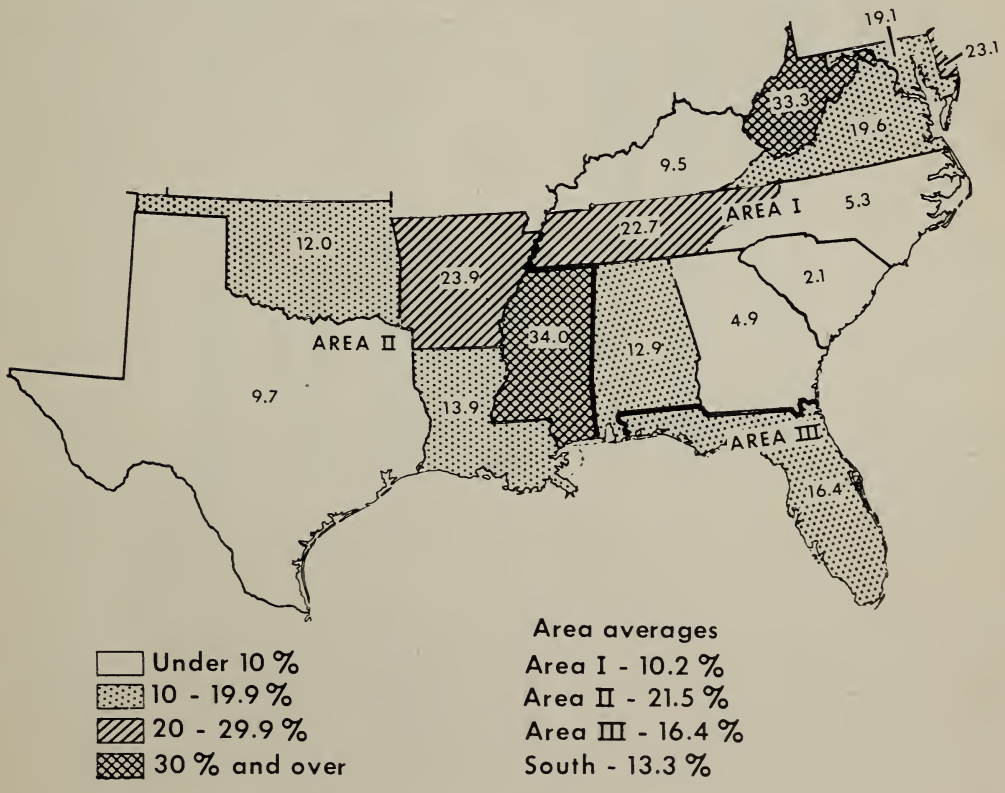
The Place of Cooperatives

Cooperatives in the South handled about 13 percent of total farmer expenditures for fertilizer in 1954. This was below the 18 percent average for all cooperatives in the United States and the 28 percent for those in the North Atlantic States, but above the 11 percent for cooperatives in the West (table 4).

Census figures indicate that United States farmers spent about $1.3 billion for fertilizer in 1954. Data supplied to Farmer Cooperative Service indicate that cooperatives distributed during the calendar year 1953 or fiscal year ending June 30, 1954, a total of $232 million worth of fertilizer, or 18.2 percent of the National total.

Within the South there was considerable variation in the cooperative share from area to area and State to State. Cooperatives in Area II handled about 21.5 percent of the dollar volume in comparison with 10.2 percent in Area I and 16.4 percent in Area III (table 5 and figure 3). State to State

Figure 3.—Cooperative sales of fertilizer as a percentage of farmer expenditures for fertilizer in the South, by areas, 1953–54



shares for cooperatives ranged from 2.1 percent in South Carolina to 34 percent in Mississippi.

Data obtained in the present study indicated the cooperatives' position in the fertilizer industry of the South improved in the more recent years. While total volume of fertilizer declined from 11.1 million tons in 1951 to 10.7 million tons in 1956, cooperatives increased their volume from 1 million tons to approximately 1.4 million tons (table 6). Percentage-wise, cooperative volume increased from 9.1 percent of the total in 1951 to 12.8 percent of the total in 1956, as shown in figure 4.

Annual Changes in Volume

Total fertilizer consumption increased 6.3 percent in the United States from 1951 through 1956, but consumption in the South declined about 4 percent (table 7 and figure 5). Areas I and II showed declines of 8 and 6 percent respectively while Area III increased consumption by more than one-third.

Although total consumption of fertilizer in the South declined about 4 percent during the 6-year

Table 6.—Proportion of total commercial fertilizer used in the South supplied by 31 cooperatives, 1951–56

Year ended June 30	Tons of fertilizer used	Tons of fertilizer supplied by cooperatives	Proportion supplied by cooperatives
Area I	*Thousands*	*Thousands*	*Percent*
1951	7, 860	532	6. 8
1952	8, 143	584	7. 2
1953	8, 051	618	7. 7
1954	7, 732	623	8. 1
1955	7, 560	703	9. 3
1956	7, 216	702	9. 7
Area II			
1951	2, 257	378	16. 8
1952	2, 303	411	17. 9
1953	2, 139	397	18. 6
1954	2, 130	400	18. 8
1955	2, 089	449	21. 5
1956	2, 119	501	23. 6
Area III			
1951	1, 002	105	10. 4
1952	1, 090	105	9. 6
1953	1, 155	113	9. 8
1954	1, 185	120	10. 1
1955	1, 229	142	11. 6
1956	1, 339	168	12. 5
South			
1951	11, 119	1, 014	9. 1
1952	11, 536	1, 100	10. 5
1953	11, 345	1, 128	9. 9
1954	11, 046	1, 143	10. 3
1955	10, 878	1, 294	11. 9
1956	10, 674	1, 370	12. 8

Figure 4.—Percentage of total fertilizer tonnage used in the South supplied by 31 cooperatives, year ended June 30, 1951–56

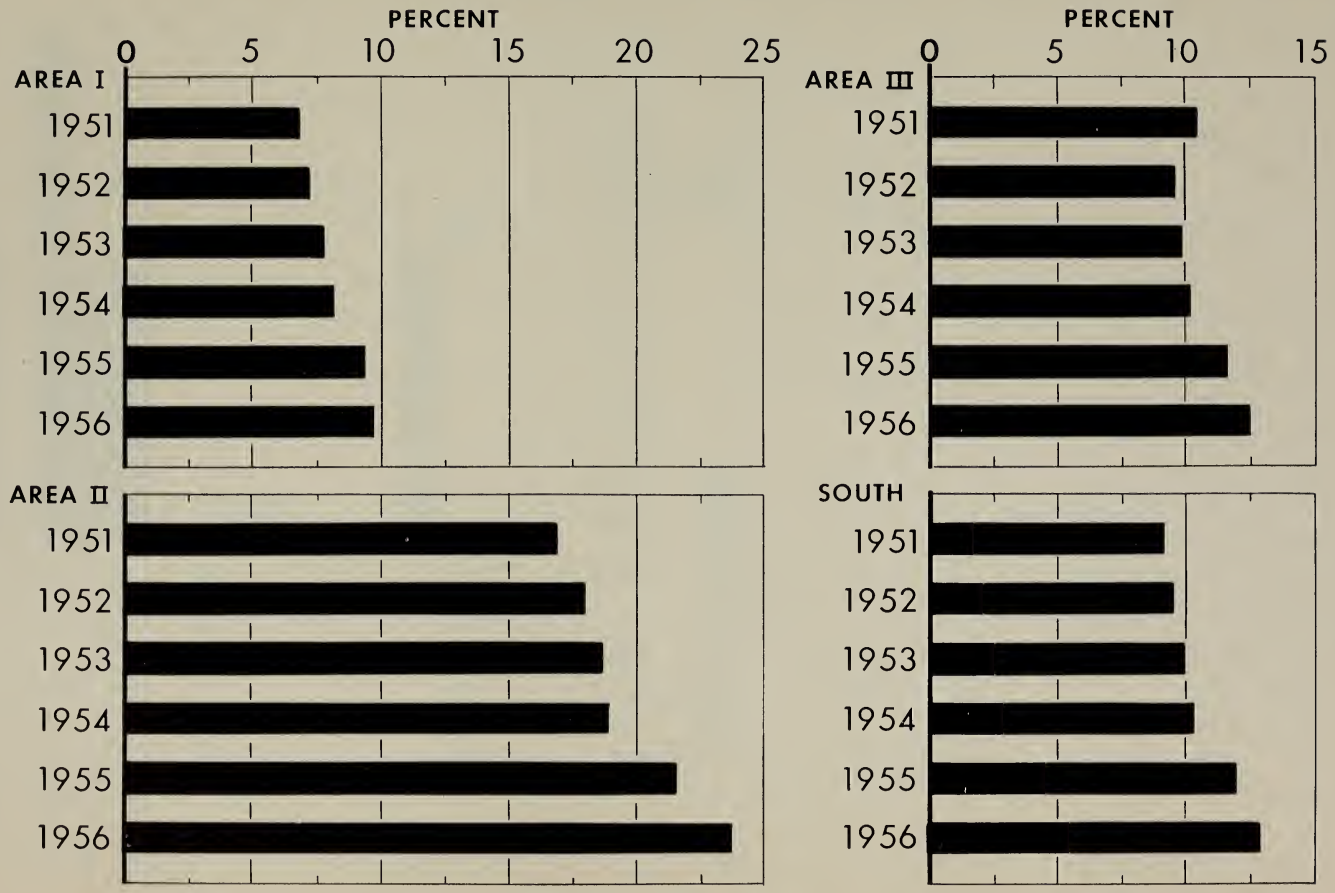


Table 7.—Changes in industrywide volume and cooperative volume of fertilizer, 1951–56

Area	Industrywide volume	Cooperative volume
	Percent	*Percent*
I	−8. 2	+32. 1
II	−6. 1	+32. 4
III	+33. 6	+60. 2
South	−4. 0	+35. 1
United States	+6. 3	

period, cooperative volume in this region increased 35 percent. The largest increase was in Area III where cooperative volume in 1956 was 60 percent greater than in 1951. Cooperatives in both Area I and II increased their fertilizer sales by 32 percent during this period.

Figure 6 and appendix table 1 show that cooperative fertilizer volume in the South increased each year from 1951 through 1956, whereas total volume dropped steadily. The largest increases in cooperative volume occurred in the last 2 years when competitive conditions in the fertilizer industry were extremely keen.

Figure 5.—Percentage changes in industrywide and cooperative fertilizer volume in the South, 1956 compared with 1951

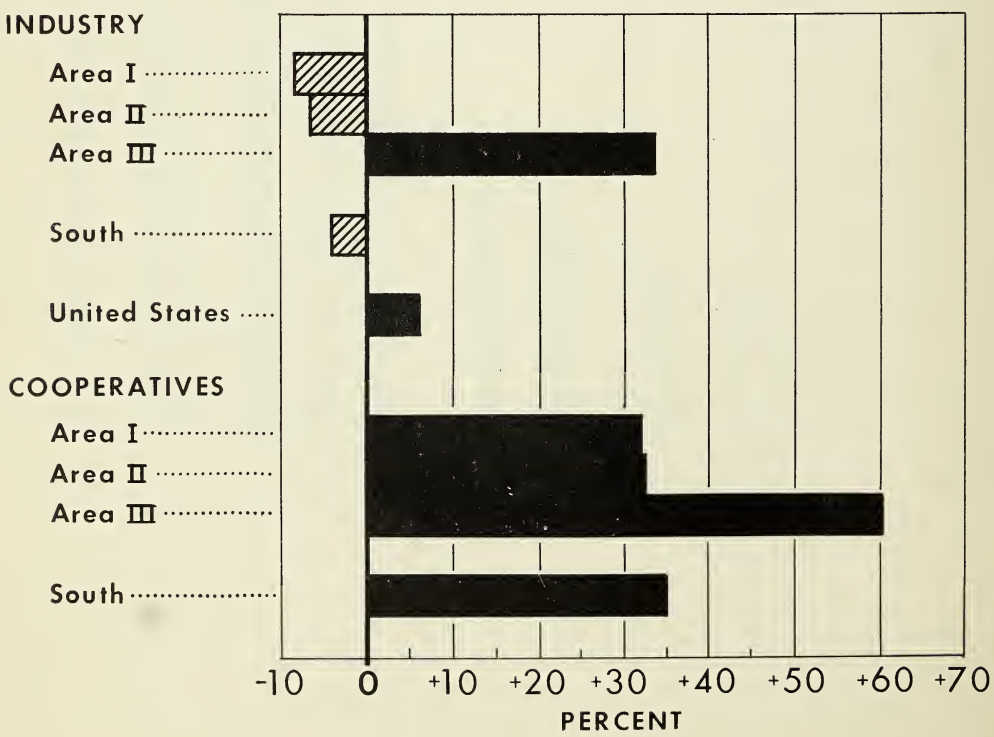
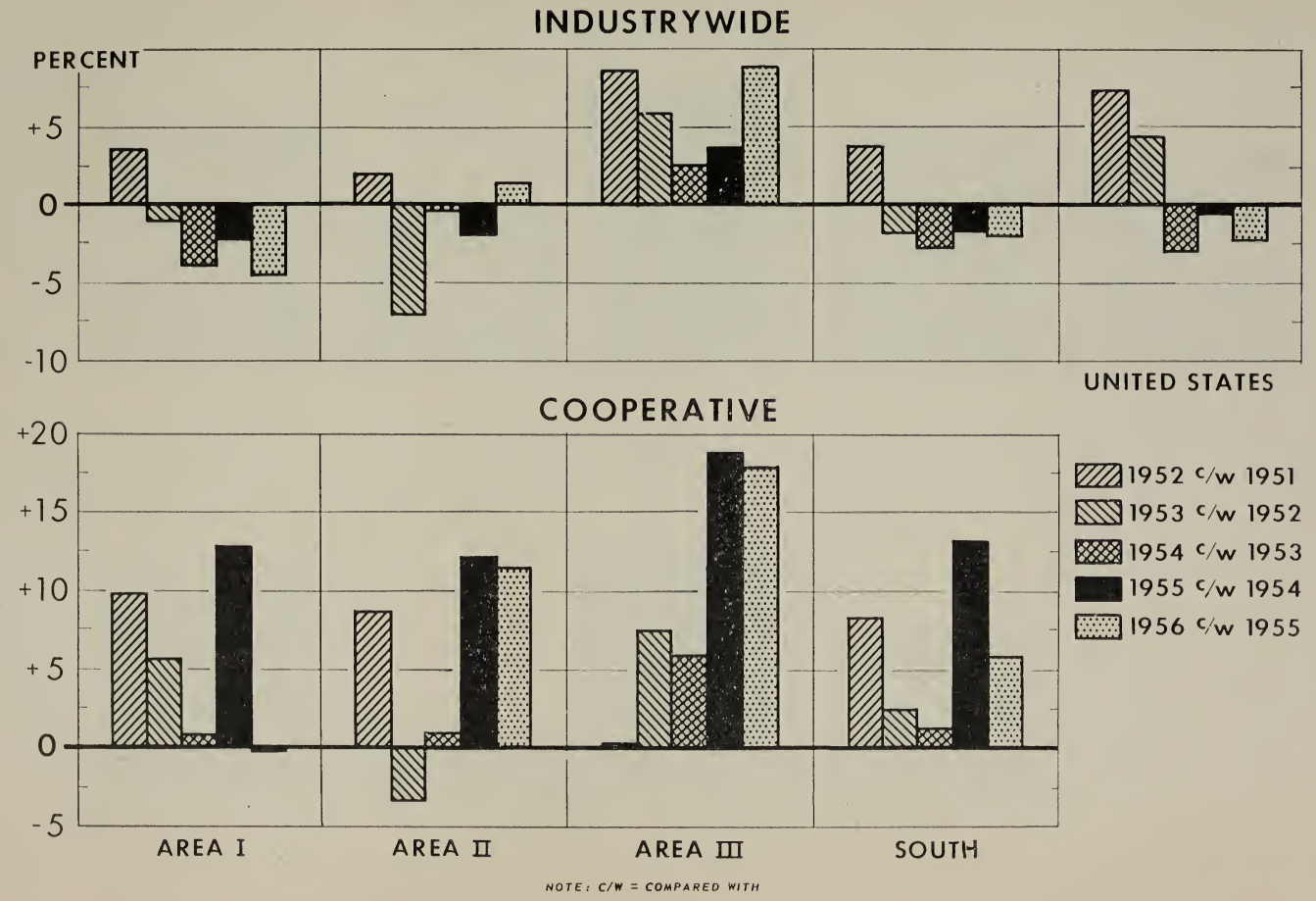


Figure 6.—Percentage changes in industrywide and cooperative volume of commercial fertilizer in three areas of the South and the United States, year ended June 30, 1951–56



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Mixtures and Separate Materials

The advantage of mixtures over separate materials is that several plant nutrients can be put into the soil in one application of a chemically balanced fertilizer. Separate materials, on the other hand, cost less per unit of plant food. The relative merits of mixtures versus separate materials has become a subject of increasing interest because of the growth in importance of bulk blending plants and multihopper spreaders in certain areas of the country. These developments make it possible for the farmer to apply several separate materials in any combination in one application, thus getting the advantages of both mixtures and separate materials.

This section examines trends in distribution or use of these two classes of fertilizer materials on an industrywide and a cooperative basis.

Industrywide Trends

Mixtures were relatively more important in the South than over the Nation as a whole—accounting for nearly three-fourths of total fertilizer volume used in this region. Moreover, the relative importance of mixtures in the South appeared to be increasing to some extent. In 1951, mixtures accounted for about 71 percent of the total fertilizer volume used, compared to about 75 percent in 1956 (figure 7 and appendix tables 2 and 3).

Over the United States mixtures made up about two-thirds of the volume of commercial fertilizer used. This proportion changed relatively little in the 6 years from 1951 to 1956. The percentage of total fertilizer volume which was mixtures in 1951 was 66.6 percent compared to 66.7 percent in 1956.

The relative importance of mixtures and separate materials varied considerably in the three areas of the South covered in this study. In Areas III and I mixed fertilizer accounted for about 90 and 79 percent of the total, respectively, whereas in Area II mixtures accounted for only 49 percent of the total. Only in Area I did there appear to be a definite upward trend in the importance of mixed fertilizer compared to separate materials. They increased from 75.4 percent of the total in 1951 to 79.1 percent of the total in 1956.

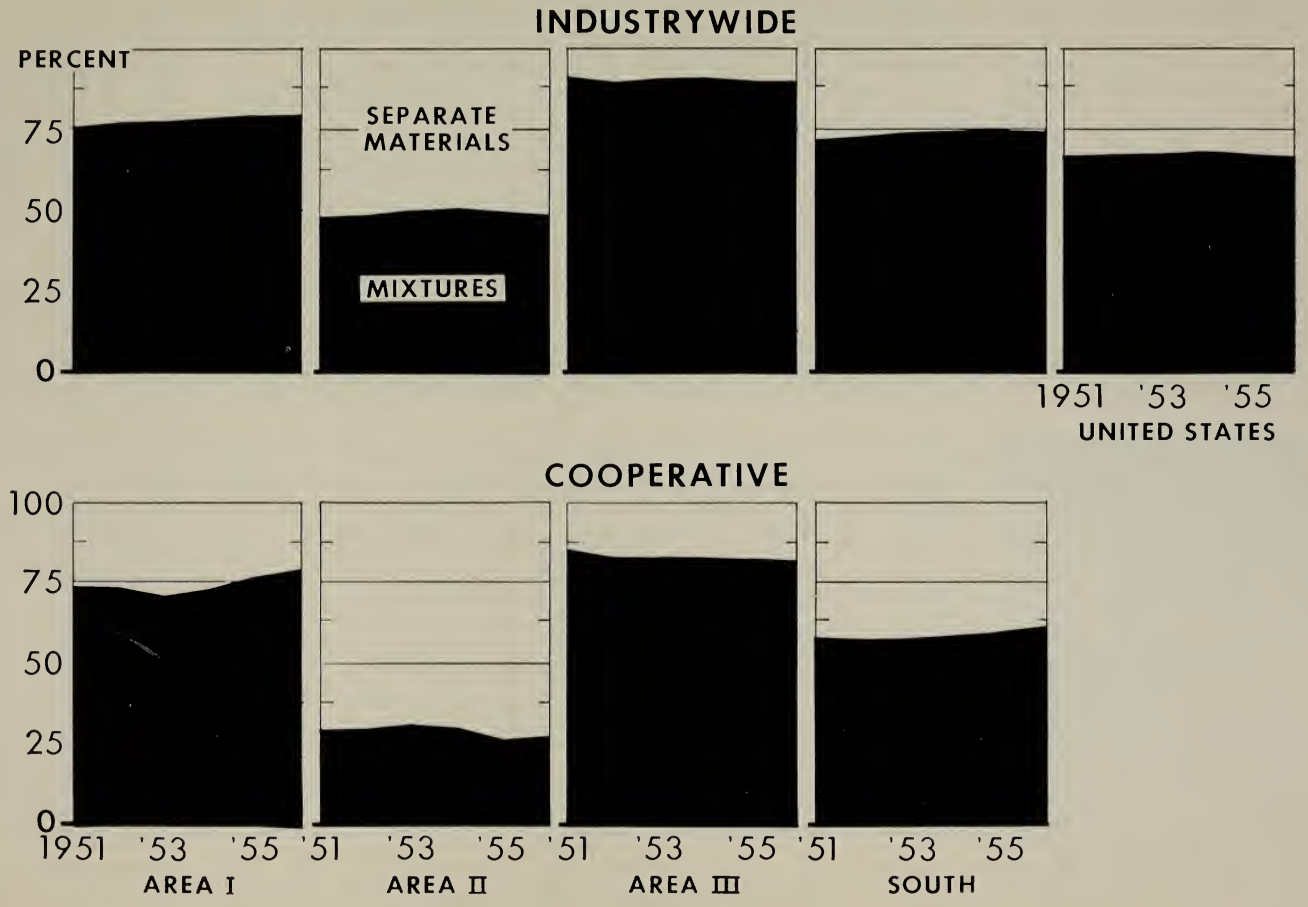
Cooperative Trends

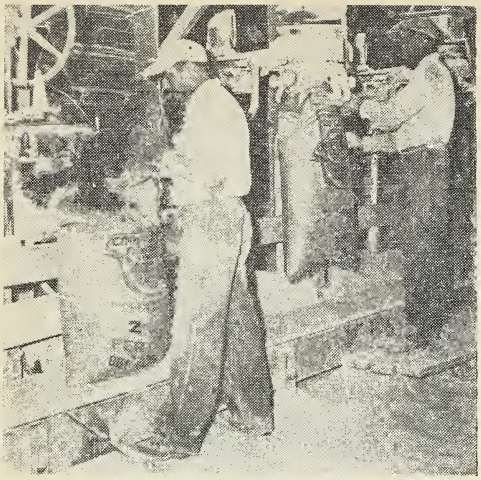
Mixed fertilizer was somewhat less important compared with separate materials among cooperatives than in the rest of the industry in the South. Mixtures made up approximately 60 percent of cooperative volume compared with approximately 75 percent for the industry as a whole (figure 7 and appendix table 4). Separate materials, on the other hand, were relatively more important among the cooperatives than in the industry generally.

The relative importance of mixtures and separate materials varied a great deal in the three areas included in this study. In Area III mixtures in 1956 accounted for approximately 82 percent of total fertilizer volume compared with about 79 percent in Area I and 27 percent in Area II. As already mentioned, the industrywide percentages for mixtures were 90 percent in Area III, 79 in Area I, and 49 percent in Area II.

Changes in the relative importance of mixtures and separate ma-

Figure 7.—Mixtures and separate materials as percentages of annual industrywide and cooperative fertilizer volume, year ended June 30, 1951–56





Farmers Cooperative Exchange, Inc., Raleigh, N. C., bags fertilizer at its Salisbury, N. C., plant for distribution to its members.

terials, although rather slight, appeared relatively significant in Area I and Area III. In Area I mixtures increased from 73.4 percent of total fertilizer volume in 1951 to 78.8 percent in 1956. In Area III, however, mixtures appeared to have declined somewhat in importance relative to separate materials. In this area mixtures declined from 85.7 percent of the total in 1951 to 81.9 percent of the total in 1956. Conversely, separate materials increased from 14.3 percent of the total in 1951 to 18.1 percent of the total in 1956.

Trends in Use of Mixed Fertilizer

This section considers changes between 1951 and 1956 in (1) number of mixed fertilizer grades handled, (2) kinds of mixtures handled, and (3) plant nutrient content of mixtures.

Number of Mixed Grades

During 1956, southern cooperatives distributed 165 different grades of mixed fertilizer (table 8). This number is based only on primary plant nutrients. If secondary and trace elements or other special ingredients had been considered in classifying grades, the number would have been larger. Duplications in grades between cooperatives have also been eliminated.

The number of grades handled had nearly doubled since the 1951 season when 90 were handled. The number of grades handled per association in 1956 averaged about 19 (table 9). This compared with an average of 13 grades 6 years previously.

The trend in all areas seemed to be toward a larger variety of grades. A reasonable number of grades is needed to fit varying soil and crop conditions. However, an excessive number of grades will increase costs to the patron because of the added number of mixtures to manufacture, handle, and store. Any increase in the number of grades, therefore, should be carefully examined.

Kinds of Mixtures

Mixed fertilizer containing all three primary nutrient elements accounted for a large majority of the mixtures distributed by cooperatives in the South (table 10). The proportion accounted for by complete fertilizers varied from 85.5 percent in Area I to 92.9 percent in Area II.

Mixed fertilizers containing only phosphorus and potassium were next in importance, accounting for one-tenth of the cooperative volume in the South. This kind of mixture was most important in Area I. This may have been due in part to the impetus given mixtures made from calcium metaphosphate and muriate of potash by the TVA fertilizer program.

Table 8.—Number of grades of fertilizer mixtures distributed by cooperatives in three areas of the South, year ended June 30, 1951–56 [1]

Area	1951	1952	1953	1954	1955	1956
I	47	58	54	59	71	86
II	34	39	43	54	53	54
III	35	35	53	61	53	62
South	90	110	118	141	143	165

[1] Grades classified on basis of primary plant nutrients only.

Nitrogen-potash mixtures were second in importance in Area III. Experiments have indicated that the phosphorus content of citrus soils have been built up over a period of years and consequently the need for this element is not so great as the need for nitrogen and potash. This is reflected in data in figure 8, which show the low average phosphorus content of mixtures distributed by cooperatives in Area III.

Plant Nutrient Content

Industrywide Trends.—Mixed fertilizer used in the South in 1956 contained on the average about 4 units of plant food [2] less than the average for the United States as a whole—24.4 units compared to 28.6 units (figure 8 and appendix table 5). Apparently this is due, in part at least, to proximity to phosphate rock deposits. Because of this, normal superphosphate continues to be the lowest-cost source of phosphate in this area.

The average plant food content of mixed fertilizer varied considerably in the three areas of the South. In Area III mixed fertilizer contained an average of only 20.9 units of plant food for the 1956 season compared to 24.5 units in Area I and 28.2 units in Area II. Only in Area II did the plant food content of mixed fertilizer compare favorably with the United States average.

From 1951 to 1956 the average plant food content of mixed fertilizer used in the United States increased from 24.1 units to 28.6 units. The change in the South during this period was from 21.5 units to 24.4 units. The increase

[2] A unit of plant food is 20 pounds, or 1 percent of a ton.

Table 9.—Average number of fertilizer grades handled by each cooperative distributor, year ended June 30, 1951–56 [1]

Area	1951	1952	1953	1954	1955	1956
I	15. 8	16. 8	15. 4	17. 7	19. 1	21. 3
II	8. 7	10. 8	12. 7	13. 3	16. 2	17. 1
III	18. 5	19. 5	19. 7	21. 3	14. 8	15. 4
South	12. 9	14. 9	15. 2	16. 6	17. 3	18. 6

[1] Grades classified on the basis of primary plant nutrients only.

Table 10.—Kinds of mixtures as percentages of cooperative and industrywide fertilizer tonnage in three areas of the South and the United States, year ended June 30, 1956

Kind of mixture	Cooperative				Industrywide	
	Area I	Area II	Area III	South	South	United States
N–P–K	85. 5	92. 9	88. 0	89. 2	91. 6	90. 9
N–P	(1)	0. 1	0	(1)	0. 6	2. 0
P–K	11. 0	7. 0	1. 8	10. 0	5. 3	5. 8
N–K	0. 5	0	10. 2	0. 8	2. 5	1. 3
	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Less than .05 percent.

in units of plant food was most marked in Area II. Area I also showed considerable increase whereas Area III showed very little change.

Cooperative Trends.—Mixed fertilizer distributed by cooperatives in the South in 1956 contained on the average about 2 units more of plant food per ton than all mixed fertilizer consumed in this region—26.3 units compared to 24.4 units [3] (figure 7 and appendix tables 5 and 6).

This illustrates the emphasis cooperatives place on serving members efficiently. However, cooperatives did not set the pace in all areas of the South. In Area II, for example, cooperatively mixed fertilizer contained an average of only 26.6 units of plant food in 1956 compared to 28.2 units for all mixed fertilizer used in this area.

Cooperatives in Area III were placing emphasis on the use of nitrogen and potash and de-emphasizing the use of phosphate in mixed fertilizer. This occurred to a greater extent among cooperatives than in the industry in general and is in agreement with latest State agricultural experiment station recommendations for the area.

[3] Plant food content of cooperatively distributed fertilizer is based on the proportions of total cooperative volume given in appendix table 14.

Trends in Use of Separate Materials

Use of separate materials for direct application has increased in recent years. An examination of trends in use of these materials, both in the industry generally and among cooperatives, should be helpful to management in developing sound plans for the future. Trends in separate materials use are examined in this section under the following headings: (1) Relative importance of separate materials, (2) nitrogen materials, (3) phosphate materials, (4) potash materials, and (5) liquid fertilizer materials.

Relative Importance

The industrywide percentage breakdown of separate materials for direct application is given in table 11. These data show that, over the Nation as a whole for the fiscal year 1956, nitrogen materials

Figure 8.—Units of primary plant nutrients per ton in mixed fertilizer, year ended June 30, 1951–56

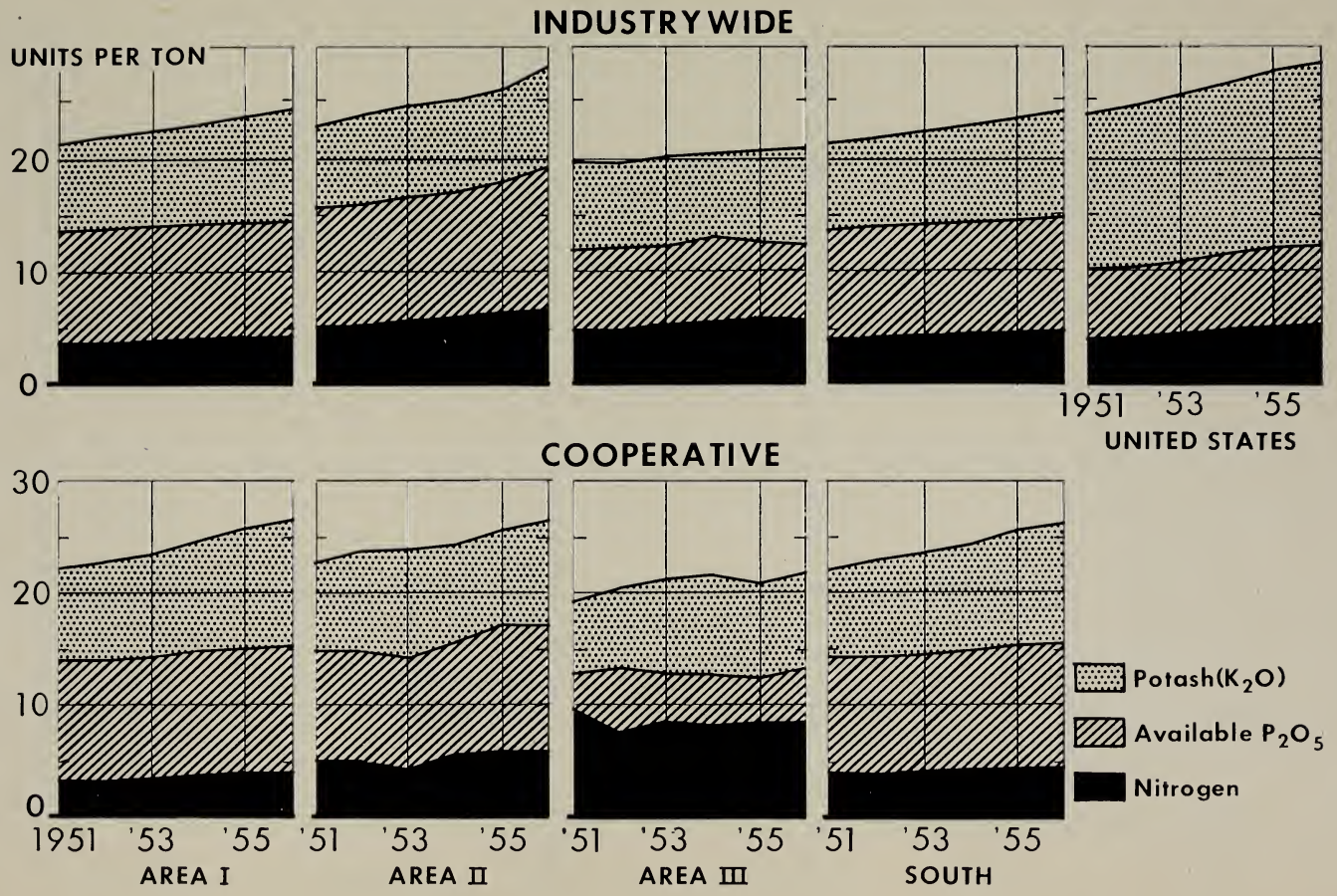


Table 11.—Percentage distribution of separate materials consumed in three areas of the South, and the United States, year ended June 30, 1951–56

Area and type of material	1951	1952	1953	1954	1955	1956
Area I						
Nitrogen	45. 8	53. 2	58. 4	65. 9	69. 6	68. 5
Phosphate	45. 3	37. 0	31. 2	22. 6	18. 1	17. 6
Potash	5. 0	6. 9	6. 5	7. 4	7. 8	7. 7
Secondary and trace element	3. 9	2. 9	3. 9	4. 1	4. 5	6. 2
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Area II						
Nitrogen	41. 0	43. 6	50. 8	56. 9	60. 4	58. 7
Phosphate	53. 6	50. 7	43. 0	36. 7	33. 8	35. 0
Potash	4. 9	5. 0	5. 7	6. 1	5. 7	6. 1
Secondary and trace element	. 5	. 7	. 5	. 3	. 1	. 2
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Area III						
Nitrogen	43. 1	36. 8	52. 5	55. 7	59. 6	54. 7
Phosphate	33. 0	32. 4	27. 2	23. 6	20. 9	27. 0
Potash	20. 3	13. 2	17. 3	18. 1	16. 4	14. 7
Secondary and trace element	3. 6	17. 6	3. 0	2. 6	3. 1	3. 6
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
South						
Nitrogen	43. 9	48. 9	55. 5	62. 1	65. 7	63. 9
Phosphate	48. 1	42. 1	35. 4	29. 0	24. 2	25. 0
Potash	5. 4	6. 4	6. 5	7. 3	7. 3	7. 4
Secondary and trace element	2. 6	2. 6	2. 6	2. 6	2. 8	3. 7
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
United States						
Nitrogen	36. 5	40. 6	44. 6	52. 7	53. 1	49. 9
Phosphate	50. 6	44. 6	39. 7	34. 0	30. 8	33. 9
Potash	3. 5	4. 2	4. 4	5. 1	5. 3	5. 4
Secondary and trace element	9. 4	10. 6	11. 3	8. 2	10. 8	10. 8
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

accounted for half of all separate materials used for direct application and phosphate materials for about one-third.

There has been a decline in relative importance of phosphate materials and an increase in importance of nitrogen materials. This has occurred over the Nation as a whole as well as in the three different areas of the South.

A percentage breakdown of separate materials distributed by cooperatives in the South is shown in table 12. Nitrogen materials accounted for over 63 percent of the total for the 1955–56 season, while phosphate made up 30 percent and potash about 7 percent.

The different classes of materials varied considerably in importance in the three areas between 1951 and

1956. In Area III nitrogen materials made up 81 percent of the total, compared to 70 percent in Area I, and 59 percent in Area II. Phosphate materials made up 36 percent of the total in Area II, 17 percent in Area I, and only 7 percent in Area III. Potash materials were relatively more important in Area I, while secondary and trace element materials distributed were larger in Area III than elsewhere.

Among cooperatives, as in industry as a whole, distribution of phosphate materials declined and that of nitrogen materials increased in the period 1951–56. Phosphate materials made up 67 percent of total cooperative volume in 1951 while nitrogen materials accounted for only 27 percent. By 1956, the situation was reversed with phosphate materials accounting for only 30 percent and nitrogen materials making up 63 percent. The relative position of potash materials remained at 6 to 7 percent of the total during this period.

The cooperative breakdown for the South was very similar to that for the industry, except that secondary and trace element materials were relatively more important in the industry generally than among

Table 12.—Percentage distribution of separate materials distributed by cooperatives in three areas of the South, year ended June 30, 1951–56 [1]

Area and type of material	1951	1952	1953	1954	1955	1956
Area I						
Nitrogen	39. 2	57. 4	65. 9	66. 0	67. 1	70. 5
Phosphate	52. 6	35. 2	27. 8	25. 0	22. 9	16. 9
Potash	7. 7	7. 0	5. 8	8. 7	9. 7	10. 7
Secondary and trace element	. 5	. 4	. 5	. 3	. 3	1. 9
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Area II						
Nitrogen	23. 3	37. 3	49. 8	57. 1	61. 7	59. 0
Phosphate	71. 6	59. 2	43. 8	37. 4	33. 6	36. 1
Potash	5. 0	5. 5	6. 4	5. 5	4. 7	4. 9
Secondary and trace element	. 1	(2)	(2)	(2)	(2)	(2)
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Area III						
Nitrogen	49. 9	86. 6	90. 1	97. 2	84. 5	81. 3
Phosphate	35. 4	10. 2	4. 2	1. 0	6. 4	7. 1
Potash	14. 1	3. 1	2. 3	1. 0	7. 7	7. 1
Secondary and trace element	. 6	. 1	3. 4	. 8	1. 4	4. 5
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
South						
Nitrogen	27. 1	44. 8	56. 8	61. 0	63. 8	63. 1
Phosphate	67. 1	49. 1	36. 9	32. 3	29. 7	29. 7
Potash	5. 7	6. 0	6. 1	6. 6	6. 4	6. 5
Secondary and trace element	. 1	. 1	. 2	. 1	. 1	. 7
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.

[2] Less than .05 percent.

Employees of Cotton Producers Association, Adel, Ga., load fertilizer for distribution to association members. From the bagging machine, bags fall on a belt conveyer that carries them direct to a waiting truck.

cooperatives. This may mean that cooperatives need to examine more closely farmers' needs for secondary and trace element materials. The importance of such materials is being recognized more and more in all parts of the country.

Nitrogen Materials

Total industry volume of nitrogen materials distributed in the South increased only slightly in the 1951–56 period (table 13). Such materials distributed by cooperatives totaled 342,000 tons in fiscal 1956. This was a nearly threefold increase over 1951. Thus, cooperatives increased their share of the nitrogen materials market from about 8 percent in 1951 to approximately 20 percent in 1956. No doubt the biggest factor in this in-

Table 13.—Cooperative and industrywide tonnage of nitrogen materials in the South and the United States, 1951–56

Year ended June 30	Cooperative tonnage in the South	Industrywide tonnage	
		South	United States
	Thousands	*Thousands*	*Thousands*
1951	134	1, 408	2, 504
1952	209	1, 551	2, 843
1953	269	1, 651	3, 261
1954	288	1, 754	3, 579
1955	335	1, 817	3, 832
1956	342	1, 698	3, 153

crease was the nitrogen manufacturing and distribution program of Mississippi Chemical Corporation at Yazoo City, Miss.

The most apparent differences in consumption of nitrogen materials in the South as compared to that of the United States generally were: (1) Sodium nitrate was relatively more important in the South; (2) natural organic materials were less important in the South; and (3) nitrogen solution and aqua ammonia made up only 2.3 percent of nitrogen materials used in the South in 1956, while accounting for one-tenth of all such materials consumed in the country as a whole (table 14).

About two-thirds of the gross cooperative tonnage of nitrogen materials in 1956 was ammonium nitrate. Anhydrous ammonia and sodium nitrate accounted for about 13 and 10 percent, respectively.

Ammonium nitrate increased considerably in importance among cooperative distributors during the 6-year period covered by this study, apparently replacing some of the sodium nitrate volume. Anhydrous ammonia also greatly increased in importance—from 3.8 percent of the nitrogen materials volume in 1951 to 12.7 percent in 1956.

A marked difference existed in the relative position of different nitrogen materials handled by cooperatives and the industry generally in the South. For example, sodium nitrate made up only 10 percent of the cooperative volume in 1956, compared with 30 percent of total industry volume in the South. Conversely, ammonium nitrate made up only 29 percent of the 1956 industrywide total in the South compared with 66 percent of the cooperative total. This indicated that cooperatives of the area were setting the pace in distribution of higher-analysis nitrogen materials.

Data in appendix table 7 indicate

Employees of Farmers Cooperative Exchange, Inc., Raleigh, N. C., load bagged fertilizer at the Salisbury plant for distribution to retail outlets.

anhydrous ammonia was relatively more important in Area II than in other areas of the South. With the exception of some solution nitrogen

Table 14.—Percentage distribution of nitrogen materials for direct application, year ended June 30, 1951–56

Material	1951	1952	1953	1954	1955	1956
Cooperative—South [1]						
Anhydrous ammonia	3. 8	9. 8	7. 3	10. 9	9. 0	12. 7
Ammonium nitrate	64. 2	63. 6	68. 2	66. 3	68. 9	66. 5
Ammonium nitrate limestone mix	4. 9	3. 8	4. 5	4. 5	5. 8	4. 9
Ammonium sulphate	2. 8	2. 1	2. 0	2. 1	1. 8	. 7
Calcium cyanamide	. 9	1. 1	1. 3	1. 0	1. 3	. 9
Calcium nitrate	. 9	. 9	1. 5	2. 0	1. 4	2. 7
Nitrogen solutions and aqua ammonia	. 2	[2]	. 1	0	. 1	. 3
Sodium nitrate	21. 6	18. 6	15. 0	12. 9	11. 2	10. 1
Urea	[2]	[2]	. 1	[2]	. 3	. 6
Organic materials	. 7	. 1	[2]	. 3	. 2	. 6
Other	0	[2]	0	0	[2]	[2]
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Industrywide—South						
Anyhydrous ammonia	[3]	[3]	[3]	[3]	7. 4	9. 8
Ammonium nitrate	24. 0	27. 8	26. 8	24. 7	29. 8	29. 4
Ammonium nitrate limestone mix	12. 4	13. 9	18. 4	20. 4	19. 4	17. 8
Ammonium sulphate	5. 8	5. 8	5. 1	4. 7	3. 6	4. 0
Calcium cyanamide	3. 0	1. 9	3. 3	2. 7	2. 5	2. 6
Calcium nitrate	. 9	. 9	. 7	. 7	. 7	. 6
Nitrogen solutions and aqua ammonia	[3]	[4] 1	. 3	. 6	1. 3	2. 3
Sodium nitrate	47. 3	42. 5	37. 8	36. 3	33. 1	30. 5
Urea	[3]	[3]	[3]	[3]	. 7	1. 1
Organic materials	1. 5	. 8	1. 4	1. 4	1. 4	1. 8
Other	5. 1	6. 3	6. 2	8. 5	. 1	. 1
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Industrywide—United States						
Anhydrous ammonia	4. 7	5. 9	6. 7	9. 8	9. 2	11. 5
Ammonium nitrate	25. 4	28. 1	25. 9	25. 8	29. 1	25. 9
Ammonium nitrate limestone mix	7. 7	9. 1	12. 9	10. 9	9. 3	8. 7
Ammonium sulphate	14. 1	14. 4	14. 1	13. 1	11. 6	9. 9
Calcium cyanamide	2. 6	1. 5	2. 5	1. 9	1. 8	1. 8
Calcium nitrate	2. 2	1. 7	1. 5	1. 4	1. 5	1. 5
Nitrogen solutions and aqua ammonia	[4] 7	[4] 7	2. 2	4. 7	7. 7	10. 1
Sodium nitrate	27. 3	24. 0	19. 9	18. 3	16. 1	15. 0
Urea	[3]	[3]	[3]	[3]	1. 6	2. 3
Organic materials	12. 7	12. 1	11. 0	11. 7	12. 0	13. 0
Other	2. 6	2. 5	3. 3	2. 4	. 1	. 3
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.
[2] Less than .05 percent.
[3] Not classified; included in "Other".
[4] Aqua ammonia only; nitrogen solution included in "Other."

Workers transfer fertilizer manufactured by Mississippi Federated Cooperatives (AAL), to a fertilizer spreader for application to vetch before it is turned under.

in Area I, very little liquid fertilizer was distributed by cooperatives in the other two areas.

Table 15 shows the proportion of nitrogen plant nutrients from separate material sources supplied by the various kinds of materials. This table indicates that anhydrous ammonia supplied from 28 to 30 percent of nutrient nitrogen in cooperative and industrywide tonnage of nitrogen materials but made up only 10 to 13 percent of gross tonnage of these materials (table 14).

Over the nation as a whole anhydrous ammonia was the most important separate nitrogen material

Table 15.—Percentage breakdown of the tonnage at nitrogen plant nutrients supplied by separate materials, year ended June 30, 1956

Separate material	Cooperatives	Industrywide	
	South	South	United States
Anhydrous ammonia	28. 6	27. 5	30. 5
Ammonium nitrate	60. 9	33. 3	28. 0
Ammonium nitrate limestone	2. 8	12. 4	5. 7
Ammonium sulphate	0. 4	2. 8	6. 6
Calcium cyanamide	. 5	1. 8	1. 2
Calcium nitrate	1. 1	0. 3	0. 7
Nitrogen solutions and aqua ammonia	. 4	3. 0	12. 7
Sodium nitrate	4. 4	16. 6	7. 8
Urea	. 8	1. 8	3. 4
Natural organics	. 1	. 4	3. 2
Other	(1)	. 1	. 2
Total	100. 0	100. 0	100. 0

[1] Less than .05 percent.

in terms of nitrogen plant food supplied. Among cooperatives in the South, however, ammonium nitrate was by far the most important nitrogen source.

Phosphate Materials

Cooperative volume of phosphate materials in the southern States was approximately 161,000 tons in 1956 (table 16). This was considerably below the 1951 tonnage of 268,000 tons, but showed an increase over the 152,000 tons distributed in 1954.

Although cooperative volume declined in the more recent years, the drop was not as great percentagewise as the decline in total industry volume in the South. Cooperative volume for 1956 was 56 percent of 1951 volume, while industrywide volume in the South was only 44 percent of the earlier year. Cooperatives actually increased their share of the phosphate materials market from 19 percent in 1951 to 24 percent in 1956.

Total United States volume of phosphate materials decreased by approximately 1 million tons from 1951 to 1956. Most of this decrease occurred in the southern States largely because of a decline in tonnage of normal superphosphate and basic slag. These two items were off approximately 500,000 and 230,000 tons, respectively, in 1956 as compared to 1951.

The main phosphate material handled by cooperatives was basic slag which accounted for 63 percent of the total phosphate tonnage in 1956 (table 17). Normal superphosphate was second in importance, accounting for about one-fourth of the total. Concentrated superphosphate made up about 8 percent of the total.

No well-defined trend appeared in the kinds of phosphate materials distributed by cooperatives. The relative importance of the three major items—basic slag, normal superphosphate, and concentrated superphosphate—varied from year to year but followed no definite pattern. However, calcium metaphosphate, although of minor importance, appeared to be gaining among cooperative patrons during the period 1951–56. Fused tri-calcium phosphate also showed signs of becoming an important phosphate material with cooperatives, but its position dropped sharply when TVA quit producing it.

Table 16.—Cooperative and industrywide tonnage of phosphate materials in the South and the United States, 1951–56

Year ended June 30	Cooperative tonnage in the South	Industrywide tonnage	
		South	United States
	Thousands	*Thousands*	*Thousands*
1951	268	1, 541	3, 477
1952	229	1, 334	3, 305
1953	175	1, 053	3, 097
1954	152	789	2, 532
1955	156	670	2, 221
1956	161	682	2, 464

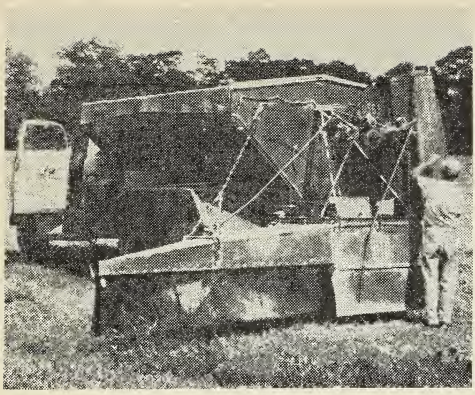
Table 17.—Percentage distribution of phosphate materials tonnage for direct application, year ended June 30, 1951–56

Material	1951	1952	1953	1954	1955	1956
Cooperative—South [1]						
Ammonium phosphate	0. 3	0. 6	0. 2	0. 1	(2)	0. 3
Ammoniated superphosphate	0	0	0	0	0	0
Basic slag	55. 1	56. 4	51. 0	46. 2	51. 5	62. 8
Calcium metaphosphate	. 2	. 8	1. 0	1. 1	2. 9	4. 4
Di-ammonium phosphate	0	0	0	0	0	. 1
Fused tri-calcium phosphate	0	1. 1	. 7	5. 3	7. 2	. 9
Phosphate rock	. 3	. 1	. 1	(2)	(2)	(2)
Colloidal phosphate	. 2	. 1	(2)	(2)	(2)	. 2
Superphosphate (18–22 percent)	33. 3	25. 8	29. 3	33. 7	27. 1	23. 6
Superphosphate (23–53 percent)	10. 6	15. 1	17. 7	12. 9	10. 8	7. 7
Bonemeal	(2)	(2)	(2)	0. 7	0. 5	(2)
Other	0	(2)	(2)	0	0	0
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Industrywide—South						
Ammonium phosphate	4. 6	5. 3	7. 4	8. 4	10. 6	10. 8
Ammoniated superphosphate	. 3	. 2	. 1	(2)	(2)	(2)
Basic slag	27. 5	30. 4	29. 1	24. 9	23. 0	25. 7
Calcium metaphosphate	. 5	. 9	. 9	1. 0	2. 2	2. 7
Di-ammonium phosphate	(3)	(3)	(3)	(3)	(3)	0. 6
Fused tri-calcium phosphate	1. 2	1. 0	1. 6	2. 9	2. 4	(3)
Phosphate rock	7. 2	9. 5	7. 4	8. 3	6. 3	8. 9
Colloidal phosphate	1. 1	1. 2	1. 6	1. 9	1. 3	1. 6
Superphosphate (18–22 percent)	52. 9	46. 2	45. 5	46. 0	44. 9	40. 5
Superphosphate (23–50 percent)	4. 3	5. 0	6. 2	5. 6	8. 4	8. 7
Bonemeal	. 2	. 2	. 2	. 3	. 4	. 3
Other	. 2	. 1	(2)	. 7	. 5	. 2
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Industrywide—United States						
Ammonium phosphate	5. 5	6. 9	8. 4	12. 0	15. 0	14. 0
Ammoniated superphosphate	. 2	. 2	. 2	. 3	. 5	. 2
Basic slag	11. 7	11. 9	9. 7	7. 7	7. 2	7. 0
Calcium metaphosphate	. 5	. 7	. 6	1. 1	2. 0	1. 7
Di-ammonium phosphate	(3)	(3)	(3)	(3)	(3)	0. 6
Fused tri-calcium phosphate	. 5	. 5	. 6	. 9	. 7	(3)
Phosphate rock	28. 6	33. 8	36. 6	34. 6	24. 2	37. 0
Colloidal phosphate	1. 2	1. 2	1. 3	1. 4	1. 0	0. 7
Superphosphate (18–22 percent)	44. 1	37. 0	33. 7	30. 9	30. 6	24. 4
Superphosphate (23–50 percent)	6. 9	6. 8	8. 0	9. 8	15. 4	13. 1
Bonemeal	. 4	. 4	. 4	. 5	. 5	. 6
Other	. 4	. 6	. 5	. 8	. 9	. 7
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.

[2] Less than .05 percent.

[3] Not separately classified, included in "Other".



This fan-type spreader truck is widely used by farm supply co-ops to deliver and spread bulk fertilizer on farmers' fields. Here the truck operator is lowering the hood to spreading position. The hood prevents fertilizer from blowing away while being spread.

Basic slag was much more important as a phosphate material with cooperatives than with the industry generally. It accounted for 63 percent of 1956 cooperative tonnage compared to only 26 percent of total southern tonnage and 7 percent of total United States tonnage.

Normal superphosphate made up about 40 percent of all phosphate materials in the South in 1956 but only 24 percent of cooperative volume. This material was relatively more important in the South than in the United States generally, accounting for only 24 percent of all phosphate tonnage in the country as a whole. Phosphate rock was much more important nationwide than in the South, as it accounted for 37 percent of the United States total compared to only 9 percent in the South. All of the basic slag used in the United States is consumed in the South.

Normal superphosphate declined in relative importance after 1951, in both the South and the country as a whole, while the more concentrated superphosphates, ammonium phosphates, and calcium metaphosphate increased in importance relative to other phosphate materials. This trend may be expected to continue as farmers and distributors learn the advantages of higher-analysis materials.

Total tons of P_2O_5 consumed in the South and the proportion supplied by separate materials are shown in the tabulation at the bottom of this page.

These figures indicate that total P_2O_5 use declined by about 10 percent and the proportion supplied in the form of separate materials declined 50 percent. Tons of P_2O_5 supplied in materials, however, did not decline as rapidly as gross tonnage of materials, thus indicating an increase in the average P_2O_5 concentration.

Appendix table 8 shows percentage distribution of phosphate materials by cooperatives in the three areas of the South, 1951–56.

Table 18 shows the proportions of available P_2O_5 from separate material sources supplied by the various kinds of phosphate materials.

Year ended June 30	*Total P_2O_5 tonnage (thousands)*	*Tonnage supplied by materials (thousands)*	*Proportion supplied by materials (percent)*
1951	1,044	269	25.8
1952	1,056	227	21.5
1953	1,015	188	18.5
1954	963	142	14.8
1955	943	131	13.9
1956	947	133	14.1

Table 18.—Percentage breakdown of available P_2O_5 suppplied by separate materials, year ended June 30, 1956

Separate material	Cooperatives	Industrywide	
	South	South	United States
Ammonium phosphate	0. 7	23. 9	32. 0
Ammoniated superphosphate	0	(1)	0. 2
Basic slag	33. 5	10. 6	3. 0
Calcium metaphosphate	16. 1	7. 8	5. 2
Di-ammonium phosphate	. 4	1. 4	1. 4
Fused tri-calcium phosphate	1. 1	(2)	(2)
Phosphate rock	(1)	1. 2	5. 3
Colloidal phosphate	. 1	0. 4	. 2
Superphosphate 18–22 percent	26. 6	35. 4	22. 1
Superphosphate 23–50 percent	21. 5	18. 8	29. 4
Bonemeal	(1)	. 3	. 6
Other	(1)	. 2	. 6
Total	100. 0	100. 0	100. 0

[1] Less than .05 percent.
[2] Not separately classified.

This table indicates basic slag was much less important in terms of the plant nutrients supplied than it was as a proportion of gross phosphate materials tonnage (table 17). However, it was still the most important separate material source of phosphate distributed by cooperatives. Industrywide data indicate normal superphosphate (18 to 22 percent) was the most important phosphorus source for the South while ammonium phosphate was in first place on a nationwide basis.

Potash Materials

Although a rather minor fertilizer item with cooperatives, potash materials for direct application showed a steady increase after 1951 (table 19). Tonnage in 1956 was half again as great as that for the

Table 19.—Cooperative and industrywide tonnage of potash materials in the South and the United States, 1951–56

Year ended June 30	Cooperative tonnage in the South	Industrywide tonnage	
		South	United States
	Thousands	*Thousands*	*Thousands*
1951	24	172	241
1952	28	204	311
1953	29	195	346
1954	31	207	378
1955	34	203	385
1956	35	203	388

earlier year. Industrywide tonnage for the South, however, increased only 17 percent during this period. Thus, cooperatives increased their share of the market from 14 percent in 1951 to 18 per-

Table 20.—Percentage distribution of potash materials for direct application, year ended June 30, 1951–56

Material	1951	1952	1953	1954	1955	1956
Cooperative—South [1]						
Lime-potash mixtures	0	4. 0	4. 3	5. 8	5. 8	3. 7
Manure salts	(2)	1. 1	0	0	0	0
Potassium chloride (48–52 percent)	22. 2	59. 8	35. 0	11. 8	8. 1	3. 4
Potassium chloride (58–62 percent)	59. 8	25. 7	56. 0	72. 5	76. 9	84. 1
Sulphate of potash magnesium	. 2	(2)	. 1	. 1	. 2	. 6
Potassium nitrate	1. 5	1. 2	. 6	1. 6	1. 6	4. 0
Potash phosphate ash	9. 7	1. 2	. 8	1. 3	. 1	0
Potassium sodium nitrate	(2)	0	0	0	0	. 1
Sulphate of potash	6. 6	7. 0	3. 2	6. 9	7. 3	4. 1
Other	0	(2)	0	0	0	0
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Industrywide—South						
Lime-potash mixtures	(3)	(3)	12. 3	11. 7	9. 9	11. 2
Manure salts	4. 4	2. 1	1. 9	1. 1	1. 0	. 5
Potassium chloride (48–52 percent)	53. 3	44. 2	38. 4	20. 9	19. 5	5. 6
Potassium chloride (58–62 percent)	17. 8	25. 2	29. 1	46. 7	50. 3	62. 2
Sulphate of potash magnesium	2. 5	1. 8	1. 8	2. 3	1. 5	1. 8
Potassium nitrate	4. 0	2. 9	4. 3	0	0	(3)
Potash phosphate ash	2. 3	1. 0	(2)	(2)	. 3	(3)
Potassium sodium nitrate	1. 2	. 9	. 9	5. 7	7. 7	10. 3
Sulphate of potash	6. 5	7. 3	7. 9	8. 6	7. 8	7. 1
Other	8. 0	14. 6	3. 4	3. 0	2. 0	2. 3
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Industrywide—United States						
Lime-potash mixtures	(3)	(3)	7. 0	6. 8	6. 4	6. 0
Manure salts	3. 5	1. 8	1. 3	. 8	. 6	. 3
Potassium chloride (48–52 percent)	45. 9	39. 5	31. 9	13. 8	9. 4	3. 4
Potassium chloride (58–62 percent)	29. 8	37. 4	46. 9	65. 0	69. 7	75. 8
Sulphate of potash magnesium	2. 3	1. 6	1. 6	2. 1	1. 6	1. 7
Potassium nitrate	3. 0	1. 9	2. 5	. 1	(2)	(3)
Potash phosphate ash	1. 6	. 7	(2)	(2)	. 1	(3)
Potassium sodium nitrate	. 9	. 8	. 6	3. 1	4. 3	5. 3
Sulphate of potash	6. 6	6. 3	6. 1	6. 4	6. 2	5. 1
Other	6. 4	10. 0	2. 1	1. 9	1. 7	1. 4
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.
[2] Less than .05 percent.
[3] Not separately classified, included in "Other."

cent in 1956. Neither cooperative nor industrywide tonnage for the South increased as rapidly, however, as the 61 percent increase in total United States tonnage of potash materials.

Recent trends in potash distribution and use have been marked by the decline in importance of 48 to 52 percent potassium chloride and the increasing importance of 58 to 62 percent potassium chloride (table 20). The same general pattern is reflected in cooperative and industrywide data for the South and in industrywide data for the United States.

Appendix table 9 shows percentage distribution of potash materials by cooperatives in the three areas of the South, 1951–56.

Table 21 shows a percentage breakdown of the tonnage of nutrient potash supplied by separate materials. Potassium chloride (58 to 62 percent) supplied over four-fifths of the nutrient potash tonnage for both cooperatives and industry generally.

Liquid Fertilizer Materials

Cooperatives in the South distributed nearly 43,000 tons of anhydrous ammonia and 1,200 tons of nitrogen solution in 1956 (table 22). This reflects a nearly tenfold increase in anhydrous ammonia volume since 1951. Practically all the anhydrous ammonia was distributed in Area II with a large part of it in the Delta areas of Mississippi, Louisiana, and Arkansas.

Eight of the 31 associations covered by this study handled anhydrous ammonia while only one handled nitrogen solution (table 23). Numbers of retail distribution points used by these nine associations are shown in the tabulation at the top of page 33.

Storage capacity for liquids totaled 12,500 tons, with approximately 97 percent for anhydrous ammonia. Area II had the largest

Table 21.—Percentage breakdown of tonnage of nutrient potash supplied by separate materials, year ended June 30, 1956

Separate material	Cooperatives	Industrywide	
	South	South	United States
Lime-potash mixtures	.3	1.2	.6
Manure salts	0	.2	.1
Potassium chloride (48–52 percent)	3.0	5.0	3.2
Potassium chloride (58–62 percent)	89.6	80.2	87.2
Potassium magnesium sulphate	.2	.9	.8
Potassium nitrate	3.2	[1]	[1]
Potassium-phosphate ash	0	[1]	[1]
Potassium-sodium nitrate	[2]	3.3	1.5
Potassium sulphate	3.7	7.7	5.8
Other	0	1.5	.8
Total	100.0	100.0	100.0

[1] Not separately classified.
[2] Less than .05 percent.

Table 22.—Tonnage of liquid fertilizers distributed by cooperatives in the South, 1951–56 [1]

Year ended June 30	Area I	Area II	Total South [2]
Anhydrous ammonia			
1951	0	4, 609	4, 609
1952	0	18, 562	18, 562
1953	13	17, 875	17, 888
1954	23	30, 137	30, 160
1955	111	28, 829	28, 940
1956	241	42, 394	42, 635
Nitrogen solution			
1951	0	209	209
1952	75	0	75
1953	168	95	263
1954	0	0	0
1955	290	0	290
1956	1, 162	0	1, 162

[1] Data covers those percentages of total separate materials volume as given in appendix table 14.
[2] Cooperatives in Area III made no distribution of either anhydrous ammonia or nitrogen solution.

share of storage capacity with approximately 11,500 tons. The remainder was in Area I. All storage in Area II was for anhydrous ammonia, whereas approximately 40 percent of that in Area I was for nitrogen solution.

The outlook for liquids varied by areas and type of material. Use of both anhydrous ammonia and nitrogen solution was expected to continue to increase in Areas I and II. Solution nitrogen appeared to have the edge over anhydrous in Area I and was expected to gain in relative importance in that area. Anhydrous ammonia was expected to continue to be popular in Area II, but some cooperative officials believed it had about reached the peak of its use in this area.

Anhydrous ammonia was not looked upon with much favor in Area III. Loss of free ammonia

Table 23.—Number and percentage of cooperatives handling liquid fertilizer in the South, 1956 [1]

Area	Cooperatives	Cooperatives distributing			Percentage handling liquid fertilizers
		Anhydrous ammonia	Nitrogen solution	Liquid mix	
I	12	2	1	0	25
II	9	6	0	0	67
III	10	0	0	0	0
South	31	8	1	0	29

[1] The term liquid fertilizer as used in this report applies to anhydrous ammonia, nitrogen solution, and liquid mixes.

Area	Retail distribution points for—	
	Anhydrous ammonia	*Nitrogen solution*
	Number	*Number*
I	7	8
II	95	0
III	0	0
South	102	8

in sandy soil was the main reason given. There was considerable interest in nitrogen solution in Area III, however, and several large distributors were testing ammonium nitrate and urea solutions on citrus. The reason given for lack of solution use was that there has been little information available on its use for citrus.

None of the cooperatives covered in this study had a definite program or plans for manufacturing and distributing liquid mixed fertilizer.[4] Two associations indicated they had been studying the situation and would possibly start a program for liquid mixes within the next 5 years. Most managers, however, believed the outlook for liquid mixes in their area rather poor and did not foresee any place for them in their program during the next 5 years. Reasons given were: (1) Liquid mixes were not competitive with dry mixes; and (2) application costs were higher.

[4] Since the completion of field work on this study, a new cooperative has been formed at Boynton Beach, Fla., to manufacture and distribute complete liquid mixed fertilizer. It has constructed a plant and plans to manufacture 10,000 to 12,000 tons of liquid fertilizer annually. Plant costs were approximately $73,000, which is considerably below costs of a comparable dry mix plant.

Cooperatives may want to continue studying possibilities of liquid mixes as well as anhydrous ammonia and nitrogen solutions. Although the economics of liquid mixes do not appear too favorable at present, future technological developments and price changes may place liquid mixes in a more favorable position. Cooperatives should be ready to incorporate them into their fertilizer programs if and when they become advantageous to the farmer.

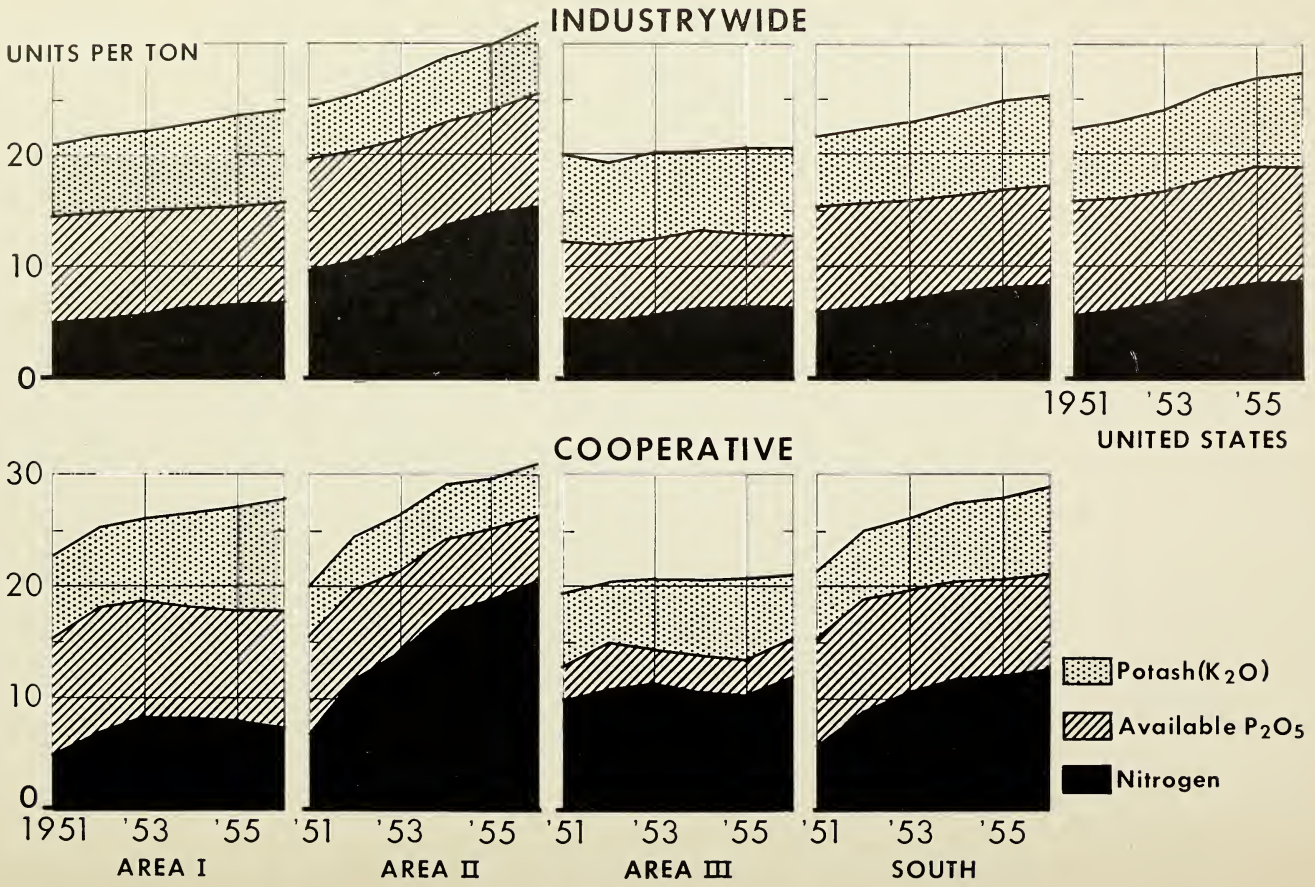
Plant Nutrient Content

To obtain the nutrient content of all fertilizers, the plant nutrient content of materials was added to that of mixtures. Appendix table 10 shows this data on an industrywide basis. Total tonnage of plant nutrients was converted to a units-per-ton basis for the presentation that follows.

Industrywide Trends

Each ton of commercial fertilizer (mixtures plus separate materials) used in the South in 1956 contained an average of 25.3 units of plant food (figure 9 and appendix table 11). This was slightly more than the 24.4 average for mixed fertilizer alone. Average units per ton in the United States for all ferti-

Figure 9.—Units of primary plant nutrients per ton in all commercial fertilizer, year ended June 30, 1951–56



lizer was 27.2 units in 1956 compared to 28.6 for mixed only (appendix tables 11 and 5). Separate materials had the most marked influence in Area II, bringing the average plant food content of fertilizer used in that area up to 31.7 units (appendix table 11). This compares with 28.2 units in mixed fertilizer only, thus indicating the importance of high-analysis separate materials in that area (appendix table 5).

Figure 8 reflects the importance of nitrogen for direct application in Area II. While mixed fertilizer used in this area contained only 6.6 units of nitrogen per ton in 1956, mixtures and materials together averaged 15.5 units.

Appendix table 12 shows units of primary plant nutrients per ton in all fertilizers distributed by cooperatives in the South, 1951–56. Appendix table 13 indicates the proportion of nitrogen supplied by mixtures in the South declined from 47.5 percent in 1951 to 41.6 percent in 1956. On the other hand, mixures supplied an increasing proportion of P_2O_5—from 74.2 percent in 1951 to 85.9 percent in 1956.

The average ratio of fertilizer used in Area II was approximately 3–2–1 as compared to nearly a 1–1–1 ratio in the other two areas. This further reflects the importance of nitrogen in fertilization programs of farmers in Area II.

Cooperative Trends

Mixtures and materials distributed by cooperatives in the South contained an average of 28.7 units of plant food per ton in 1956 (appendix table 12). This was an increase of 7 units over the average for 1951 of 21.3 units.

The most marked increase in units of plant food per ton occurred in Area II. Mixtures and materials distributed by cooperatives in this area in 1956 contained 30.9 units of plant food compared to 20 units in 1951. Most of this increase was due to the sharp increase in importance of nitrogen materials in the cooperative fertilizer programs of this area—the units of nitrogen increasing from 6.7 to 20.4. Units of nitrogen also increased sharply in the other two areas, resulting in a 119 percent increase in units of nitrogen per ton over the South as a whole.

There was also considerable increase in units of potash per ton. Units of phosphate, on the other hand, decreased during the period.

Seasonal Movement

Table 24 reflects the seasonal nature of the fertilizer industry. In 1956, of all fertilizer consumed in the United States, 73 percent was used during the spring period from January 1 to June 30. In the South, an even higher percentage of fertilizer was used during this period.

The 1956 seasonal pattern varied considerably from one area of the South to another. In Area I, 82 percent of all fertilizer was applied in the spring compared to about 73 percent for Area II and only 58 percent for Area III. The more nearly equal distribution of fertilizer between fall and spring volume in Area III was a reflection of the type of agriculture and the long growing season.

Not only was the major part of fertilizer applied in the spring; the proportion appeared to be increasing to some extent. For the United States as a whole, spring volume showed a gradual increase from 70 percent of the total in 1951 to 73

percent in 1956. A similar increase was shown for the South—from approximately 74 percent in 1951 to 77 percent in 1956. Only in Area III did there appear to be a decline in importance of spring applications.

The slight increase in seasonality probably can be explained by the fact that fertilizer supplies became

Table 24.—Fall and spring volumes of fertilizer mixtures and separate materials compared, 1951–56

Year ended June 30	Fall (July 1 to Dec. 31)				Spring (Jan. 1 to June 30)			
	Mixtures tonnage	Materials tonnage	Total fall [1] tonnage	Proportion of annual tonnage	Mixtures tonnage	Materials tonnage	Total spring [1] tonnage	Proportion of annual tonnage
Area I	*Thousands*	*Thousands*	*Thousands*	*Percent*	*Thousands*	*Thousands*	*Thousands*	*Percent*
1951	1, 128	668	1, 796	22. 8	4, 800	1, 264	6, 064	77. 2
1952	1, 106	573	1, 679	20. 6	5, 188	1, 276	6, 464	79. 4
1953	1, 108	536	1, 644	20. 4	5, 152	1, 255	6, 407	79. 6
1954	940	361	1, 301	16. 8	5, 144	1, 287	6, 431	83. 2
1955	1, 127	326	1, 453	19. 2	4, 844	1, 263	6, 107	80. 8
1956	992	292	1, 284	17. 8	4, 715	1, 216	5, 932	82. 2
Area II								
1951	162	588	750	33. 2	905	602	1, 507	66. 8
1952	147	502	650	28. 2	950	703	1, 653	71. 8
1953	154	492	646	30. 2	903	591	1, 493	69. 8
1954	152	396	549	25. 8	915	666	1, 581	74. 2
1955	212	384	596	28. 5	823	670	1, 493	71. 5
1956	202	381	582	27. 5	834	703	1, 537	72. 5
Area III								
1951	346	35	381	38. 0	572	50	622	62. 0
1952	384	48	433	39. 7	589	68	657	60. 3
1953	408	51	459	39. 8	644	52	695	60. 2
1954	415	46	461	39. 0	656	67	723	61. 0
1955	435	53	488	39. 7	671	71	742	60. 3
1956	506	54	560	41. 8	696	83	779	58. 2
South								
1951	1, 636	1, 291	2, 926	26. 3	6, 277	1, 916	8, 192	73. 7
1952	1, 638	1, 124	2, 762	23. 9	6, 727	2, 047	8, 774	76. 1
1953	1, 670	1, 078	2, 749	24. 2	6, 698	1, 898	8, 596	75. 8
1954	1, 508	803	2, 311	20. 9	6, 715	2, 020	8, 735	79. 1
1955	1, 773	763	2, 536	23. 3	6, 338	2, 004	8, 342	76. 7
1956	1, 700	727	2, 427	22. 7	6, 245	2, 003	8, 248	77. 3
United States								
1951	3, 217	2, 870	6, 086	29. 7	10, 424	3, 998	14, 427	70. 3
1952	3, 381	2, 805	6, 187	28. 1	11, 427	4, 439	15, 866	71. 9
1953	3, 556	3, 022	6, 577	28. 6	11, 898	4, 560	16, 458	71. 4
1954	3, 248	2, 542	5, 789	25. 9	12, 011	4, 562	16, 573	74. 1
1955	3, 516	2, 437	5, 954	26. 7	11, 552	4, 778	16, 330	73. 3
1956	3, 439	2, 448	5, 887	27. 0	11, 090	4, 817	15, 907	73. 0

[1] Mixtures and materials do not always add to total because of rounding.

more plentiful during the 1951–56 period. When supplies are plentiful, farmers are more inclined to postpone purchasing fertilizer until they are ready to use it.

Data on seasonal movement of fertilizer by cooperatives was obtained for only the 1955–56 fiscal year. A summary of monthly data is shown in table 25 and is graphically portrayed in figure 10. About two-thirds of the total cooperative tonnage was distributed during the spring months and about one-third in the fall months. This compares with industrywide figures of 77 percent in the spring and 23 percent in the fall (table 21). Thus, cooperatives on the average have a better seasonal distribution pattern than does the industry in general.

Getting ready for the rush season, the Lumberton, N. C., plant of Farmers Cooperative Exchange, Inc., Raleigh, N. C., has bins so full of fertilizer that bags have been put in place to help hold it.

The distribution of mixtures appeared more highly seasonal than the distribution of separate mate-

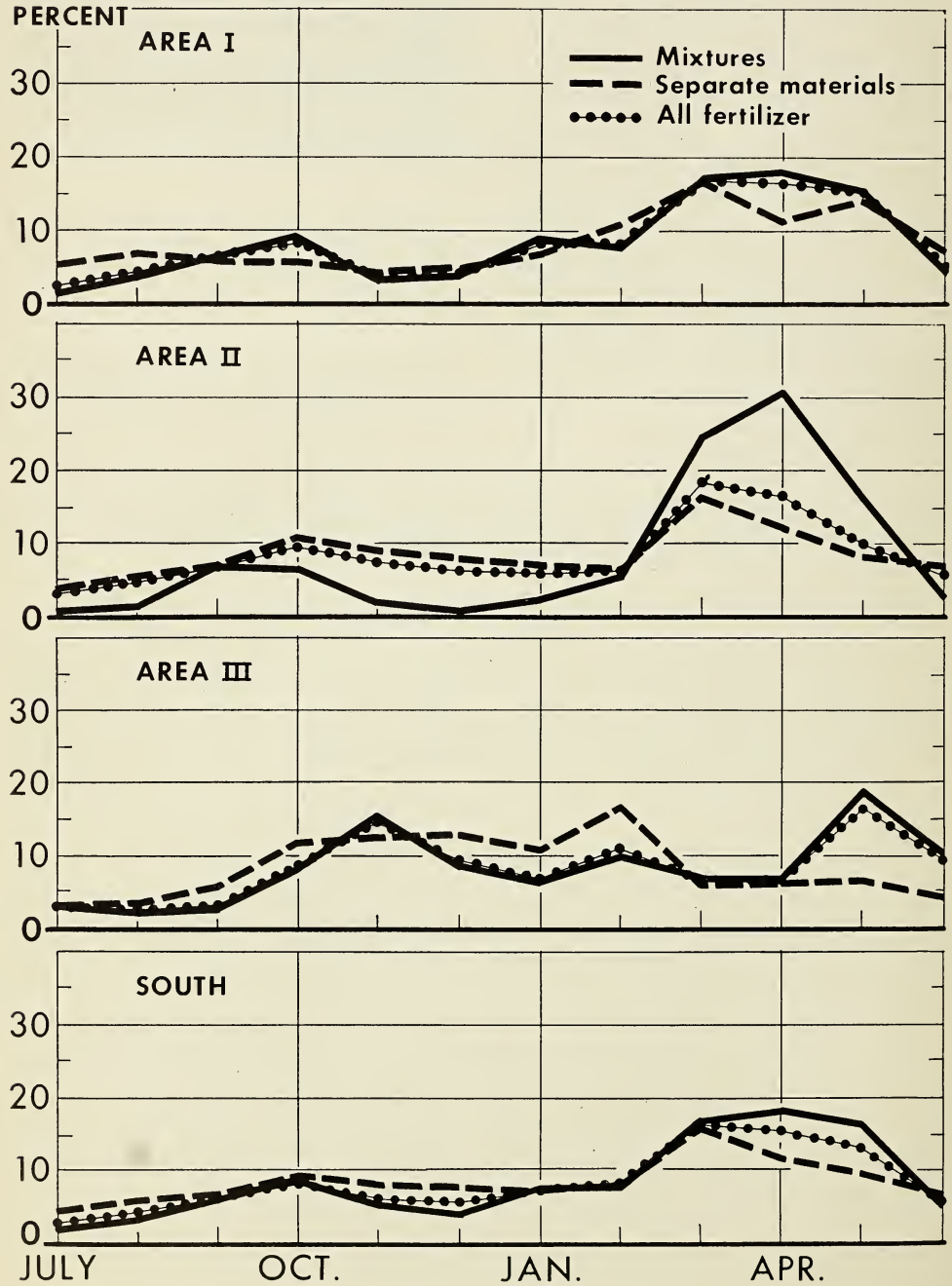
Table 25.—Monthly volume of fertilizer mixtures and separate materials for cooperatives in the South as a percentage of yearly volume, July 1955 through June 1956

Month	Area I			Area II			Area III			All Areas		
	Mixtures	Materials	All fertilizer	Mixtures	Materials	All fertilizer	Mixtures	Materials	All fertilizer	Mixtures	Materials	All fertilizer
July	1. 5	5. 2	2. 3	. 7	3. 9	3. 2	3. 2	3. 2	3. 2	1. 7	4. 2	2. 8
Aug	3. 7	7. 0	4. 4	1. 5	5. 4	4. 5	2. 3	3. 5	2. 5	3. 1	5. 7	4. 2
Sept	6. 5	6. 2	6. 5	6. 8	6. 9	6. 8	2. 9	5. 6	3. 3	5. 9	6. 6	6. 2
Oct	9. 1	5. 5	8. 3	6. 5	10. 2	9. 4	8. 2	11. 6	8. 8	8. 6	9. 1	8. 8
Nov	3. 4	4. 4	3. 6	2. 0	8. 9	7. 3	15. 2	12. 5	14. 8	5. 2	7. 9	6. 3
Dec	3. 9	4. 8	4. 1	0. 7	7. 9	6. 3	8. 8	12. 7	9. 5	4. 2	7. 4	5. 6
Fall	28. 1	33. 1	29. 2	18. 2	43. 2	37. 5	40. 6	49. 1	42. 1	28. 7	40. 9	33. 9
Jan	8. 8	6. 7	8. 4	2. 3	6. 9	5. 9	6. 2	10. 8	7. 0	7. 4	7. 0	7. 2
Feb	7. 8	10. 8	8. 4	5. 3	6. 6	6. 3	9. 9	16. 5	11. 0	7. 8	8. 2	7. 9
Mar	17. 1	16. 6	17. 0	24. 6	16. 2	18. 1	7. 1	5. 9	6. 9	16. 6	15. 8	16. 3
Apr	18. 0	11. 1	16. 5	30. 6	12. 3	16. 4	7. 1	6. 4	7. 0	18. 0	11. 7	15. 3
May	15. 6	14. 2	15. 3	16. 1	8. 1	9. 9	18. 5	6. 9	16. 5	16. 2	9. 6	13. 4
June	4. 6	7. 5	5. 2	2. 9	6. 7	5. 9	10. 6	4. 4	9. 5	5. 3	6. 8	6. 0
Spring	71. 9	66. 9	70. 8	81. 8	56. 8	62. 5	59. 4	50. 9	57. 9	71. 3	59. 1	66. 1

rials. Approximately 71 percent of the cooperative tonnage of mixtures was distributed during the spring season compared to only 59 percent of separate materials tonnage (table 22).

March, April, and May were high-volume months for both mix-

Figure 10.—Monthly volume of fertilizer mixtures and separate materials distributed by cooperatives as percentage of total yearly volume, year ended June 30, 1956



tures and materials, while July and August were low-volume months for both.

The seasonal nature of the fertilizer business contributes to increased costs of fertilizer to the farmer. It requires excessive storage space at the plant and results in expensive manufacturing equipment remaining idle a good part of the year. Cooperatives in most areas of the country have taken the lead in promoting greater use of fertilizer during the fall and winter seasons by giving off-season discounts (page 40). Success with these programs will save farmers considerable sums.

Merchandising Practices

THIS section briefly examines a few of the more important merchandising practices used by cooperatives in selling fertilizer. The practices covered deal mostly with pricing and are as follows: (1) Delivered and plant pricing, (2) cash and credit pricing, (3) off-season discounts, (4) patronage refund policies, and (5) bag sizes.

Delivered and Plant Pricing

About two-thirds of the 31 cooperatives surveyed followed the practice of pricing fertilizer mixtures and materials on a delivered basis with one price for their entire territory (table 26). Three cooperatives priced on a delivered basis but had established a system of zones with one price prevailing in each zone. The zones in two instances were established on the basis of distance from the cooperatives' manufacturing plants. In the other case involving a multiplant operation, a zone was established around each plant. Within each of these zones a uniform price prevailed.

Nine cooperatives priced their fertilizer on an f. o. b. plant basis and one used an f. o. b. basing point basis.

There is considerable controversy as to which of these common bases for pricing is most in agreement with cooperative principles. The argument for a uniform delivered price is that distant patrons, by increasing the volume through the

Table 26.—Delivered and plant pricing methods used by 31 cooperatives in three areas of the South, 1956

Basis for pricing	Number of cooperatives			
	Area I	Area II	Area III	South
Uniform delivered price	8	7	5	20
Zone delivered price	1	2	0	3
F. o. b. plant price	2	1	6	9
F. o. b. basing point price	1	0	0	1
Total	12	[1] 10	[1] 11	[1] 33

[1] One association in Area II and one in Area III used both the uniform delivered price and the f. o. b. plant price.

plant, permit more efficient operation. It is claimed, also, that distant patrons contribute capital on the same basis as patrons located near the plant. Thus, nearby patrons benefit from the patronage and capital contribution of patrons farther away. The argument against a uniform pricing policy is that it penalizes patrons close to the plant by forcing them to bear part of the expense of delivering materials to more distant patrons.

The system of pricing a cooperative chooses must be adapted to the particular situation in which it operates. Size of the territory covered, nature of competition in different parts of the territory, and need for additional volume to attain efficient operations are all important considerations in choosing a pricing policy.

Pricing policies of cooperatives which were primarily regional compared to those which were essentially local in character are shown in the tabulation below.

Cash and Credit Pricing

Only four of 18 associations doing credit business charged extra for this service (table 27). Nine associations reported doing cash business only. Such information was not obtained from four associations.

Credit is becoming an increasingly important problem of farm supply cooperatives. A recent study by Farmer Cooperative Service showed that costs of extending credit by diversified farm supply cooperatives amounted to approximately 2 percent of total credit business.[5] Results of this study suggest that credit should be recognized as an added service and a price set for it.

Off-Season Discounts

Because of the highly seasonal nature of the fertilizer business, a number of cooperatives as well as private fertilizer distributors have attempted to spread out the season by offering off-season or early movement discounts. These discounts are designed to increase fall use of fertilizer, or encourage storage of fertilizers on the farm or at retail points. Successful off-season discount programs would help to relieve congestion at plants during the rush season, permit more

[5] Bailey, John M. Credit Control in Selected Retail Farm Supply Co-ops, Gen. Rpt. 35, Farmer Cooperative Service, U. S. Dept. of Agr., June 1957.

Bases for pricing	Number of cooperatives	
	Regional	Local
Uniform delivered price	[1] 12	[1] 8
Zone delivered price	2	1
F. o. b. plant price	[1] 3	[1] 6
F. o. b. basing point price	0	1
Total	17	16

[1] One local and one regional association used both the uniform delivered price and the f. o. b. plant price.

Table 27.—Cash and credit pricing terms used by 31 cooperative fertilizer distributors in the South, 1956

Pricing terms	Number of cooperatives			
	Area I	Area II	Area III	All areas
Charge extra for credit	3	0	1	4
No charge for credit	3	7	4	14
Cash only	4	0	5	9
Not determined	2	2	0	4
Total	12	9	10	31

efficient use of storage space, and spread the work load more evenly throughout the year, thus reducing idle plant time.

Numbers of associations offering off-season discounts for purchases of fertilizer are shown in the accompanying tabulation.

Area	*Total number of cooperatives*	*Number offering discounts*	*Percent offering discounts*
I	12	9	75
II	9	7	78
III	10	0	0
South	31	16	52

These data indicate that about half the cooperatives covered in this study had an active early movement program. Some three-fourths of those in Areas I and II but none in Area III had early movement programs. Probably the type of agriculture and the longer growing season, which permitted a more even use of fertilizer throughout the year, accounted for the absence of such programs in Area III.

Estimates of the effectiveness of early movement programs varied from those that were considered ineffective to those that were estimated to increase the off-season movement as much as 50 percent. Managers of cooperatives having ineffective programs believed such programs to be handicapped by (1) lack of farm storage space, (2) not enough discount to interest farmers, (3) fear of price decline, (4) desire not to tie up operating capital, and (5) adverse weather conditions. Lack of farm storage space and size of discount were most frequently mentioned as factors limiting the effectiveness of these programs.

Operator of a spreader truck adjusts opening to control rate of application in spreading mixed fertilizer on a farmer's field.

Programs varied from 3 to 6 months in length. The longer programs commonly started in July and ended in December or January. Shorter programs usually started in December or January and ended in February or March. Discounts were lowered each month as the regular season approached. For example, the July early movement discount in several instances was $5 or $6 a ton but was decreased approximately $1 each month through December. For the shorter programs, discounts each month usually were as follows:

Month	*Discount per ton*
December or January	$1.50 to $2.00
January or February	1.00 to 1.50
February or March	0.50 to 1.00

One cooperative, following the practices of large private fertilizer distributors, offered fertilizer to retail outlets on a consignment basis. Such fertilizer was not to be paid for until after it was sold. The manager estimated this method of selling increased off-season volume by better than 50 percent.

Another regional cooperative operated a quota system. Local outlets were not eligible to receive off-season discounts until they reached an established quota. The manager considered this system very effective in increasing off-season movement. A certain amount of friendly rivalry between retail outlets helped in building fertilizer volume.

Patronage Refunds

Refunds to patrons on fertilizer purchases totaled over $5 million or 7.7 percent of total fertilizer purchases during the fiscal year ended June 30, 1956 (table 28). Cooperatives in Area II returned the highest rate in patronage refunds—12.4 percent of purchases. The record for this area was greatly influenced by the outstanding performance of Mississippi Chemical Corporation, Yazoo City, in the manufacture of anhydrous ammonia and ammonium nitrate.

The most common method of distributing current net savings was part in cash and part in revolving fund certificates or other types of equities. About half the cooperatives used this method. Others made cash refunds or allowed credit on future purchases, and some refunded savings in revolving fund certificates almost exclusively. Certificates representing earlier year's savings were then retired in cash. In a number of instances a small part of current savings was

Table 28.—Patronage refunds on fertilizer by 31 cooperatives in the South, fiscal year ended June 30, 1956 [1]

Area	Amount	Percent of dollar volume
I	$1,427,557	4.4
II	3,200,896	12.4
III	410,360	5.5
South	5,038,813	7.7

[1] Data adjusted to eliminate duplication due to business between cooperatives.

retained in an allocated or unallocated reserve.

About half the associations computed refunds on a commodity basis, while the other half lumped all farm supply items together. Some cooperatives declared separate refunds on mixtures and separate materials. Where savings vary a great deal on individual fertilizer items this practice may be advisable, but it adds considerably to the bookkeeping job.

Bag Sizes

Although considerable fertilizer is still packed in 100-pound bags, 80-pound bags are becoming increasingly popular and three cooperatives reported much success with 50-pound bags. Farmers were reported to like the 50-pound bags because hoppers on farm implements could comfortably hold 50 pounds, but they were not large enough for 80 or 100 pounds. In addition, 50-pound bags were much easier to handle in dumping fertilizer into hoppers which were sometimes head-high.

The trend to smaller-size bags will probably continue and other cooperatives may want to examine farmer acceptance of 50-pound bags. Bag and bagging costs, however, were estimated about 20 percent higher for 50-pound bags than for 100-pound bags.

Delivery Practices

THE increase in freight rates for fertilizer in recent years has tended to shift a large part of the outbound movement from rail to trucks. As a result more and more cooperatives are acquiring their own truck fleets to move fertilizer from point of manufacture to con-

The dump trailer truck on the right may be used to haul incoming raw materials to the fertilizer plant or to service spreader trucks in the field. Each trailer compartment can be dumped separately.

Table 29.—Mode of transportation used by cooperatives in shipping fertilizer from their plants to local outlets or farmers and percentage of tons moved by each, 1956

Mode of transportation	Area I	Area II	Area III	South
	Percent	*Percent*	*Percent*	*Percent*
Truck	77	82	98	81
Rail	23	18	2	19
Water	0	0	0	0
Total	100	100	100	100

sumption areas. Following are discussions of practices of cooperatives in this study on kinds of transportation used, truck ownership, distances hauled, and bulk delivery and spreading.

Kinds of Transportation Used

Trucks were used to haul 81 percent of all fertilizer tonnage from cooperative plants or warehouses to local retail outlets or farmers (table 29 and figure 11). Only 19 percent of the tonnage was moved by rail. These figures reflected what had been a rather widespread shift to trucks for outbound movement in more recent years. There was general agreement among managers that this shift to trucks had been brought about by increases in rail freight rates.

Cooperatives in Area III used trucks for 98 percent of their outbound tonnage. This compared with 77 percent in Area I and 82 percent in Area II. There was no outbound movement by water in any area of the South.

Ownership of Trucks

Cooperatively owned trucks were used to move 46 percent of outbound fertilizer tonnage (table 30 and figure 11). This was equally divided between the associations' own trucks and other cooperative trucks—mostly those of affiliated local associations. Contract and common carrier trucks were used for 29 percent of the tonnage, while farmers themselves hauled 25 percent in their own trucks.

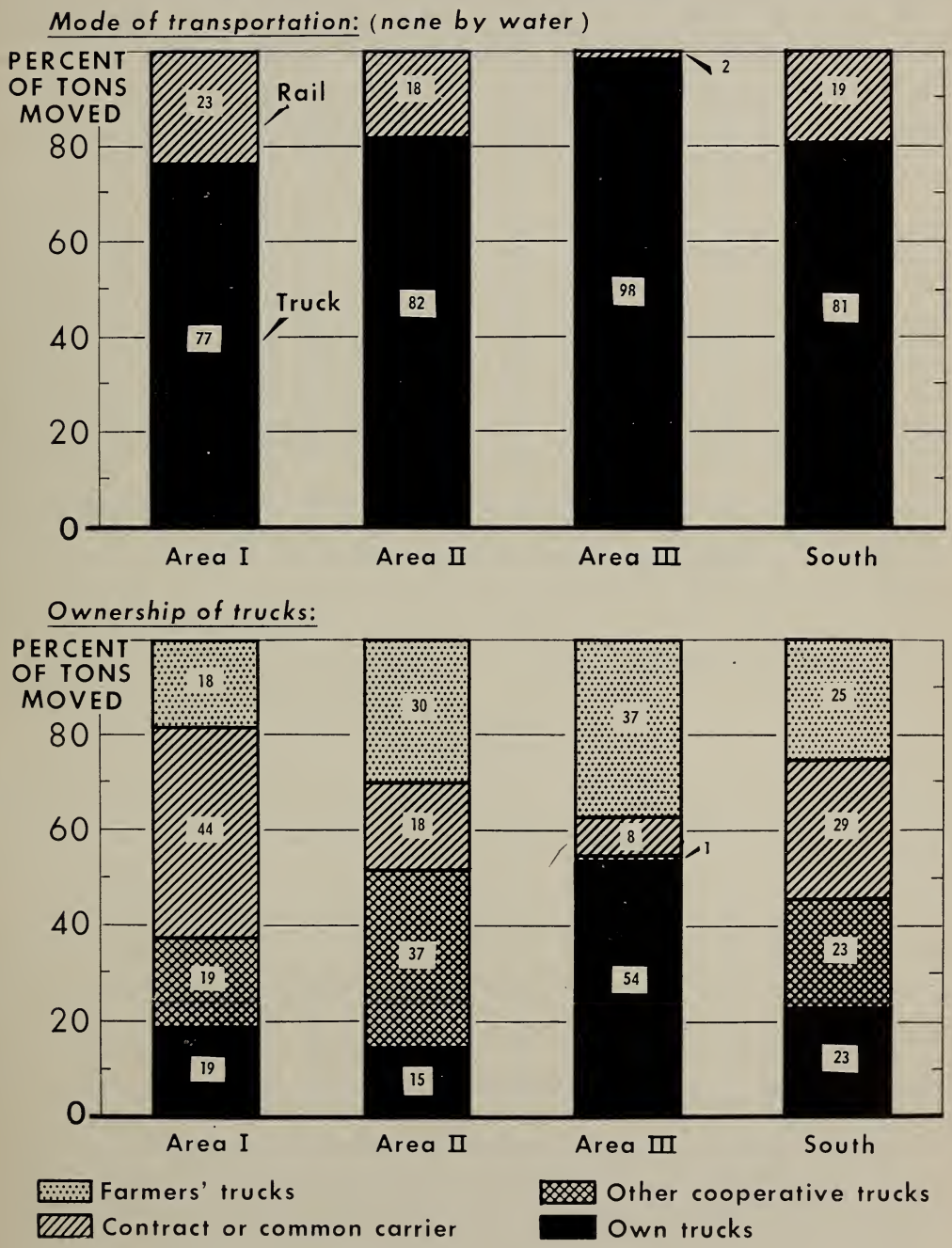
The pattern of truck ownership varied considerably among the three areas. Contract and common carrier trucks predominated in Area I, moving 44 percent of the volume. In Area II, other cooperatives' trucks and farmers'

Table 30.—Ownership of trucks used in moving fertilizers from cooperative plants to retail outlets or farmers, and percentage of volume moved, 1956

Truck ownership	Area I	Area II	Area III	South
	Percent	*Percent*	*Percent*	*Percent*
Cooperatives' own trucks	19	15	54	23
Other cooperatives, trucks	19	37	1	23
Contract or common carrier	44	18	8	29
Farmers' trucks	18	30	37	25
Total	100	100	100	100

trucks predominated, while in Area III the associations' own trucks and farmers' trucks were most important. The importance of association-owned trucks in delivering fertilizer in Area III was in line with the large number of services provided by cooperatives in this area. These included harvesting, hauling, packing or processing, shipping and, sometimes, complete grove caretaking.

Figure 11.—Mode of transportation and ownership of trucks used by 31 cooperatives to move fertilizer from plant to retail outlet or farm, 1955–56



Distances Hauled

For the average association, half of all truck deliveries of fertilizer were made within a radius of 54 miles of the plant or warehouse, and all truck deliveries were made within a radius of 154 miles (table 31).

The average distance deliveries were made by truck in Area III was only 27 miles compared to 44 miles in Area I and 97 miles in Area II. Maximum distances averaged 90 miles in Area III, 132 miles in Area I, and 254 miles in Area II.

Cooperatives can often save on transportation costs by more closely examining relative costs of truck and rail movement. For longer hauls cooperatives included in this study generally agreed that rail movement was more advantageous. However, with the rise in rail freight rates, the distance at which rail movement becomes more advantageous has increased. In a situation like this, the best use of rail and truck transportation is difficult to achieve, and there may be considerable use of trucks for distances at which rail movements would be more economical and vice versa. Cooperatives should examine their traffic situation closely before investing heavily in motor transport facilities.

Increasing transportation costs also are likely to restrict the area that can be economically served from a given plant. In fact, one manager believed that in the future fertilizer plants would be smaller and serve smaller areas because of the pressure of transportation costs. However, because of increased mechanization and facility costs, economies of scale are becoming more important and exert a

Table 31.—Average and maximum distances fertilizer was delivered by truck from cooperatives' plants or warehouses, 1956

Distance delivered by truck	Cooperatives			
	Area I	Area II	Area III	South
Average distance	*Number*	*Number*	*Number*	*Number*
0 to 25 miles	3	0	7	10
26 to 50 miles	6	1	2	9
51 to 75 miles	3	3	1	7
76 to 100 miles	0	4	0	4
Over 100 miles	0	1	0	1
Total—all cooperatives	12	9	10	31
Average miles	44	97	27	54
Maximum distance				
0 to 75 miles	3	0	5	8
76 to 150 miles	6	3	3	12
151 to 300 miles	2	5	2	9
Over 300 miles	1	1	0	2
Total—all cooperatives	12	9	10	31
Average miles	132	254	90	154

pressure in the opposite direction. Thus, the area that can be economically served from a given plant depends on the relationship between possible economies which can be achieved through larger volume, and the increased cost of serving a larger territory. A cooperative should examine this relationship closely before deciding on the size and location of manufacturing facilities.

Bulk Delivery and Spreading

Farmers could obtain bulk fertilizer if they so desired from most of the cooperatives covered by this study. However, the proportion of total dry tonnage sold in bulk was relatively small—probably not exceeding 10 percent in Areas I and II. In Area III, however, the proportion was much higher, probably in excess of 50 percent. One cooperative in this area reported as much as 90 percent of its volume was sold in bulk.

Spreading services for dry fertilizer also were quite generally available throughout the South, but, with the exception of Area III, such services were used on a rather small part of the total tonnage. Custom spreading services with broadcast application were commonly used on pastures but were not generally accepted for row crops. However, broadcast application on row crops was believed to be increasing. Broadcast application by truck or tractor-drawn spreaders was common practice on citrus in Area III and accounted for the high proportion of bulk sales in this area.

Numbers of cooperatives providing bulk spreading services for dry fertilizer and of retail points where such services were offered are shown in the accompanying tabulation.

Area	*Number of cooperatives*	*Number of points offering service*
I	9	231
II	3	31
III	10	24
South	22	286

Conclusions

THE major conclusions that may be drawn from this study are as follows:

1. *Cooperatives are an important segment of the fertilizer industry of the South and in general are in a strong economic position.* Under the conditions that have characterized the fertilizer industry of this region, they have been able to increase their share of the total market. Even with a decline in overall consumption, cooperatives increased their volume and at the same time returned to patrons in patronage refunds an average of nearly 8 percent of dollar sales.

Cooperatives in the South still supplied a relatively small part of the total market, however—only 13 percent compared to 28 percent in the Northeast, 24 percent in the North Central Region and 18 percent nationally. This suggests that with effective integrated programs, cooperatives of the South might be in a stronger position to further develop services for farmers. In so doing, they should keep in mind the advantages of coordi-

nating efforts with other similar associations. The opportunities for such coordination will be covered more fully in Part II of this study, which will be published later.

2. *Although cooperatives were setting the pace in distribution of high-analysis mixtures within the South, they were below the national average.* This suggests the need to give greater emphasis to upgrading mixtures so as to reduce freight and handling costs—an especially important consideration with ever increasing transportation costs. More cooperatives may need to install granulating facilities in order to bring the advantage of higher-analysis mixtures to their farmer patrons. However, in programs to upgrade mixtures cooperatives should watch closely any increase in costs of raw materials lest they offset the benefit gained from lower transportation and handling costs. This is especially true in the South where phosphate sources are relatively close at hand.

3. *Cooperatives were also setting the pace in distribution of high-analysis nitrogen materials.* For example, ammonium nitrate containing 33⅓ percent nitrogen made up 66 percent of cooperative nitrogen volume compared to 29 percent of industrywide volume. Also, nitrate of soda containing only 16 percent nitrogen accounted for 30 percent of industry volume compared to only 10 percent of cooperative volume.

Cooperative phosphate materials programs appeared unsettled. The decline in importance of concentrated superphosphate from 15.1 percent of phosphate volume in fiscal 1951–52 to 7.7 percent in fiscal 1955–56 apparently was due to reduced distribution of this material in the TVA sponsored Distributor Demonstration Program.

Cooperatives should continue to stress distribution of high-analysis nitrogen materials and should reexamine their phosphate materials programs to bring them more in line with the objective of lower plant-food costs for the farmer.

4. *Liquid fertilizer distribution made up an important part of cooperative fertilizer programs in Area II.* However, cooperatives in other areas of the South appeared to be trailing the rest of the industry in distribution of liquids and should reexamine the place of these materials in their programs to serve farmers.

5. *Cooperatives in the South had adapted their operations to increased freight costs by shifting a large part of their outbound movement to trucks.* To make this shift they had to acquire their own motortruck facilities in many instances.

6. *Increases in transportation costs have somewhat restricted the area that can be economically served from a given plant.* Some cooperative managers think that fertilizer plants will be smaller and serve smaller areas in the future because of the pressure of transportation costs. However, changes in technology and increases in mechanization have made overhead costs a more important consideration. Thus, the area that can be economically served from a given plant depends upon the relationship between possible economies gained from larger volume and the increased cost of serving a larger territory. A cooperative should examine this relationship closely before making a decision on the size and location of manufacturing facilities.

Appendix

Appendix Table 1.—Year to year changes in industrywide and cooperative fertilizer volume in three areas of the South and the United States, years ended June 30, 1951–56

Yearly comparisons	Area I	Area II	Area III	South	United States
Industrywide:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1952 c/w [1] 1951	+3. 6	+2. 0	+8. 7	+3. 8	+7. 5
1953 c/w 1952	−1. 1	−7. 1	+5. 9	−1. 7	+4. 5
1954 c/w 1953	−4. 0	−0. 4	+2. 6	−2. 6	−2. 9
1955 c/w 1954	−2. 2	−1. 9	+3. 8	−1. 5	−0. 4
1956 c/w 1955	−4. 6	+1. 5	+8. 9	−1. 9	−2. 2
Cooperative:					
1952 c/w 1951	+9. 9	+8. 7	+0. 2	+8. 5	
1953 c/w 1952	+5. 7	−3. 4	+7. 6	+2. 5	
1954 c/w 1953	+0. 8	+0. 9	+6. 0	+1. 3	
1955 c/w 1954	+12. 8	+12. 2	+18. 9	+13. 2	
1956 c/w 1955	−0. 1	+11. 5	+17. 9	+5. 9	

[1] c/w=compared with. First year mentioned is base of comparison.

Appendix Table 2.—Volume of mixtures and separate materials distributed by 31 cooperatives in three areas of the South, 1951–56

Year ended June 30	Mixtures		Separate materials		Total fertilizer	
	Tons	Value	Tons	Value	Tons	Value
Area I	*Thousands*	*Thousands*	*Thousands*	*Thousands*	*Thousands*	*Thousands*
1951	390	$17, 025	141	$6, 515	531	$23, 540
1952	426	18, 598	158	7, 213	584	25, 811
1953	437	19, 452	181	8, 396	618	27, 848
1954	451	18, 974	172	9, 423	623	28, 397
1955	535	21, 811	168	10, 317	703	32, 128
1956	553	23, 380	149	8, 816	702	32, 196
Area II						
1951	109	4, 702	269	7, 689	378	12, 391
1952	120	5, 211	291	10, 863	411	16, 074
1953	123	5, 529	274	12, 346	397	17, 875
1954	121	5, 494	279	13, 561	400	19, 055
1955	117	5, 792	332	17, 084	449	22, 876
1956	137	7, 349	364	18, 450	501	25, 799
Area III						
1951	90	4, 583	15	771	105	5, 354
1952	87	4, 452	18	1, 008	105	5, 460
1953	94	4, 935	19	1, 342	113	6, 277
1954	99	5, 072	21	1, 434	120	6, 506
1955	117	5, 680	25	1, 466	142	7, 146
1956	137	6, 053	30	1, 439	167	7, 492
South						
1951	589	26, 310	425	14, 975	1, 014	41, 285
1952	633	28, 261	467	19, 084	1, 100	47, 345
1953	654	29, 916	474	22, 084	1, 128	52, 000
1954	671	29, 540	472	24, 418	1, 143	53, 958
1955	769	33, 283	525	28, 867	1, 294	62, 150
1956	827	36, 782	543	28, 705	1, 370	65, 487

Appendix Table 3.—Total use of commercial fertilizer mixtures and separate materials and proportion of total in three areas of the South, 1951–56

Year ended June 30	Tons used		Proportion of total	
	Mixtures	Separate materials	Mixtures	Separate materials
	Thousands	*Thousands*	*Percent*	*Percent*
Area I				
1951	5, 928	1, 932	75. 4	24. 6
1952	6, 294	1, 850	77. 3	22. 7
1953	6, 260	1, 791	77. 8	22. 2
1954	6, 085	1, 648	78. 7	21. 3
1955	5, 971	1, 589	79. 0	21. 0
1956	5, 708	1, 509	79. 1	20. 9
Area II				
1951	1, 067	1, 189	47. 3	52. 7
1952	1, 098	1, 205	47. 7	52. 3
1953	1, 056	1, 083	49. 4	50. 6
1954	1, 067	1, 062	50. 1	49. 9
1955	1, 034	1, 054	49. 5	50. 5
1956	1, 036	1, 084	48. 9	51. 1
Area III				
1951	917	85	91. 5	8. 5
1952	974	116	89. 3	10. 7
1953	1, 052	103	91. 1	8. 9
1954	1, 072	113	90. 4	9. 6
1955	1, 106	123	90. 0	10. 0
1956	1, 201	138	89. 7	10. 3
South				
1951	7, 913	3, 206	71. 2	28. 8
1952	8, 365	3, 171	72. 5	27. 5
1953	8, 368	2, 976	73. 8	26. 2
1954	8, 226	2, 823	74. 4	25. 6
1955	8, 111	2, 767	74. 6	25. 4
1956	7, 944	2, 730	74. 4	25. 6
United States				
1951	13, 640	6, 868	66. 5	33. 5
1952	14, 808	7, 244	67. 2	32. 8
1953	15, 454	7, 581	67. 1	32. 9
1954	15, 258	7, 104	68. 2	31. 8
1955	15, 068	7, 216	67. 6	32. 4
1956	14, 529	7, 265	66. 7	33. 3

Appendix Table 4.—Distribution and proportion of total of commercial fertilizer mixtures and separate materials by 31 cooperatives in three areas of the South, 1951–56

Year ended June 30	Tons distributed		Proportion of total	
	Mixtures	Separate materials	Mixtures	Separate materials
	Thousands	*Thousands*	*Percent*	*Percent*
Area I				
1951	390	142	73. 4	26. 6
1952	427	158	73. 0	27. 0
1953	437	181	70. 8	29. 2
1954	450	172	72. 3	27. 7
1955	535	168	76. 1	23. 9
1956	553	149	78. 8	21. 2
Area II				
1951	110	269	29. 0	71. 0
1952	120	291	29. 2	70. 8
1953	123	274	30. 9	69. 1
1954	121	279	30. 3	69. 7
1955	117	332	26. 0	74. 0
1956	137	364	27. 3	72. 7
Area III				
1951	90	15	85. 7	14. 3
1952	87	18	83. 0	17. 0
1953	94	19	83. 1	16. 9
1954	99	20	82. 9	17. 1
1955	118	25	82. 6	17. 4
1956	137	30	81. 9	18. 1
South				
1951	589	425	58. 1	41. 9
1952	634	467	57. 6	42. 4
1953	654	474	58. 0	42. 0
1954	671	472	58. 7	41. 3
1955	769	525	59. 4	40. 6
1956	828	543	60. 4	39. 6

Appendix Table 5.—Units of primary plant nutrients per ton in mixed fertilizer used in three areas of the South and the United States, 1951–56

Year ended June 30	Nitrogen	Available P_2O_5	K_2O	Total primary plant nutrients
Area I	*Units per ton*	*Units per ton*	*Units per ton*	*Units per ton*
1951	3. 6	10. 1	7. 7	21. 4
1952	3. 7	10. 2	8. 2	22. 1
1953	3. 9	10. 2	8. 6	22. 6
1954	4. 0	10. 2	9. 0	23. 2
1955	4. 1	10. 3	9. 5	23. 8
1956	4. 1	10. 5	9. 8	24. 5
Area II				
1951	5. 2	10. 6	7. 3	23. 1
1952	5. 3	10. 8	7. 7	23. 8
1953	5. 7	11. 0	8. 1	24. 8
1954	6. 0	11. 2	8. 2	25. 4
1955	6. 2	11. 8	3. 4	26. 4
1956	6. 6	12. 7	9. 0	28. 2
Area III				
1951	4. 9	7. 1	7. 9	19. 8
1952	4. 9	7. 2	7. 4	19. 6
1953	5. 3	7. 0	7. 9	20. 2
1954	5. 5	7. 7	7. 4	20. 5
1955	5. 8	6. 8	8. 3	20. 8
1956	5. 7	6. 8	8. 4	20. 9
South				
1951	4. 0	9. 8	7. 7	21. 5
1952	4. 1	9. 9	8. 8	22. 0
1953	4. 3	9. 9	8. 4	22. 6
1954	4. 5	10. 0	8. 7	23. 1
1955	4. 6	10. 0	9. 2	23. 8
1956	4. 7	10. 2	9. 5	24. 4
United States				
1951	4. 0	11. 2	8. 9	24. 1
1952	4. 2	11. 2	9. 4	24. 8
1953	4. 5	11. 4	9. 9	25. 8
1954	4. 9	11. 7	10. 3	26. 8
1955	5. 1	12. 0	10. 8	27. 9
1956	5. 2	12. 2	11. 2	28. 6

Appendix Table 6.—Units of primary plant nutrients per ton in mixed fertilizer distributed by cooperatives in three areas of the South, 1951–56 [1]

Year ended June 30	Nitrogen	Available P_2O_5	K_2O	Total primary plant nutrients
Area I	*Units per ton*	*Units per ton*	*Units per ton*	*Units per ton*
1951	3. 3	10. 7	8. 2	22. 2
1952	3. 2	10. 8	8. 8	22. 8
1953	3. 4	10. 9	9. 3	23. 6
1954	3. 7	11. 0	9. 9	24. 6
1955	3. 9	11. 1	10. 6	25. 6
1956	3. 9	11. 4	11. 1	26. 4
Area II				
1951	5. 0	9. 9	7. 9	22. 7
1952	4. 9	10. 0	8. 8	23. 7
1953	4. 3	9. 9	8. 6	23. 9
1954	5. 5	10. 1	8. 8	24. 3
1955	6. 0	11. 1	8. 6	25. 7
1956	6. 0	11. 0	9. 6	26. 6
Area III				
1951	9. 5	3. 2	6. 4	19. 1
1952	7. 6	5. 7	7. 1	20. 4
1953	8. 5	4. 2	8. 5	21. 3
1954	8. 1	4. 6	8. 9	21. 6
1955	8. 2	4. 2	8. 5	20. 8
1956	8. 4	4. 9	8. 4	21. 7
South				
1951	3. 9	10. 3	8. 1	22. 2
1952	3. 7	10. 5	8. 8	23. 0
1953	4. 0	10. 5	9. 1	23. 6
1954	4. 2	10. 6	9. 6	24. 4
1955	4. 4	10. 9	10. 2	25. 5
1956	4. 4	11. 1	10. 8	26. 3

[1] Based on the proportions of total cooperative mixed fertilizer volume appearing in appendix table 14.

Appendix Table 7.—Percentage distribution of nitrogen materials for direct application distributed by cooperatives in three areas of the South, 1951–56 [1]

Material	Year ended June 30					
	1951	1952	1953	1954	1955	1956
Area I						
Anhydrous ammonia	0	0	(2)	(2)	0. 1	0. 2
Ammonium nitrate	71. 3	64. 7	70. 3	71. 5	72. 1	69. 6
Ammonium nitrate limestone mixture	2. 3	4. 6	6. 2	8. 4	8. 0	9. 6
Ammonium sulphate	. 1	. 1	1. 2	1. 1	. 2	. 1
Calcium cyanamide	1. 6	2. 5	2. 6	1. 8	2. 4	1. 9
Calcium nitrate	. 6	1. 6	1. 4	. 8	. 6	. 5
Nitrogen solutions	(2)	. 1	. 1	0	. 3	1. 1
Sodium nitrate	22. 9	26. 3	18. 1	15. 7	16. 3	16. 8
Urea	(2)	(2)	. 1	(2)	(2)	. 1
Organic materials	1. 2	. 1	(2)	. 7	(2)	. 1
Other	0	0	0	0	(2)	(2)
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Area II						
Anhydrous ammonia	7. 9	18. 4	14. 1	18. 9	14. 1	19. 9
Ammonium nitrate	57. 5	63. 9	68. 5	64. 9	69. 1	69. 1
Ammonium nitrate limestone mixture	7. 7	3. 0	3. 1	1. 9	4. 8	2. 8
Ammonium sulphate	5. 6	3. 9	2. 7	2. 9	2. 7	1. 0
Calcium cyanamide	. 2	(2)	. 2	. 5	. 8	. 5
Calcium nitrate	1. 0	. 1	. 1	(2)	0	0
Nitrogen solutions	. 4	0	. 1	0	0	0
Sodium nitrate	19. 7	10. 7	11. 2	10. 9	8. 2	5. 8
Urea	0	0	0	0	. 3	. 9
Organic materials	0	0	0	0	0	0
Other	0	(2)	0	0	(2)	0
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
Area III						
Anhydrous ammonia	0	0	0	0	0	0
Ammonia nitrate	13. 0	24. 7	19. 1	9. 6	13. 9	19. 9
Ammonium nitrate limestone mixture	0	5. 3	. 8	. 4	. 9	2. 5
Ammonium sulphate	12. 3	1. 5	1. 2	. 3	. 7	. 6
Calcium cyanamide	0	0	0	0	. 1	. 2
Calcium nitrate	12. 2	5. 4	36. 1	75. 5	57. 1	46. 1
Nitrogen solutions	0	0	0	0	0	0
Sodium nitrate	57. 2	60. 9	40. 7	12. 3	17. 6	20. 2
Urea	0	. 4	. 6	. 3	3. 4	. 2
Organic materials	5. 3	1. 8	1. 5	1. 6	6. 3	10. 3
Other	0	0	0	0	0	(2)
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.

[2] Less than .05 percent.

Appendix Table 8.—Percentage distribution of phosphate materials for direct application distributed by cooperatives in three areas of the South, 1951–56 [1]

Material	Year ended June 30					
	1951	1952	1953	1954	1955	1956
Area I						
Ammonium phosphate	1.1	2.4	0.6	0.3	0	1.7
Ammoniated superphosphate	0	0	0	0	0	0
Basic slag	5.9	20.3	13.1	9.8	3.1	5.4
Calcium metaphosphate	.8	2.5	3.0	3.2	9.7	21.7
Di-ammonium phosphate	0	0	0	0	0	.8
Fused tri-calcium phosphate	0	4.5	2.3	18.6	28.7	5.6
Phosphate rock	0	0	0	.1	.1	.2
Colloidal phosphate	0	0	0	0	0	0
Superphosphate (18–22 percent)	53.1	15.4	25.8	24.1	28.4	35.9
Superphosphate (23–50 percent)	39.1	54.8	55.2	41.7	27.8	28.6
Bonemeal	[2]	.1	[2]	2.2	2.2	.1
Other	0	0	0	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Area II						
Ammonium phosphate	0	0	0	0	0	0
Ammoniated superphosphate	0	0	0	0	0	0
Basic slag	72.5	68.6	67.1	60.7	67.5	74.0
Calcium metaphosphate	[2]	.2	.2	.2	.6	1.1
Di-ammonium phosphate	0	0	0	0	0	0
Fused tri-calcium phosphate	0	0	0	0	0	0
Phosphate rock	.4	.1	.1	0	0	[2]
Colloidal phosphate	0	0	0	0	0	0
Superphosphate (18–22 percent)	26.5	29.3	30.8	37.6	26.7	20.9
Superphosphate (23–50 percent)	.6	1.8	1.8	1.4	5.2	4.0
Bonemeal	0	0	0	0	0	0
Other	0	0	[2]	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Area III						
Ammonium phosphate	0	0	0	0	.2	.4
Ammoniated superphosphate	0	0	0	0	0	0
Basic slag	44.4	37.0	88.3	70.2	78.0	5.6
Calcium metaphosphate	0	0	0	0	0	10.2
Di-ammonium phosphate	0	0	0	0	0	0
Fused tri-calcium phosphate	0	0	0	0	0	0
Phosphate rock	0	0	0	0	0	0
Colloidal phosphate	54.4	61.4	5.1	10.4	1.0	20.0
Superphosphate (18–22 percent)	1.2	1.3	6.6	19.4	20.0	61.8
Superphosphate (23–50 percent)	0	0	0	0	.8	2.0
Bonemeal	0	0	0	0	0	0
Other	0	.3	0	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.

[2] Less than .05 percent.

Appendix Table 9.—Percentage distribution of potash materials distributed by cooperatives in three areas of the South, 1951–56 [1]

Material	Year ended June 30					
	1951	1952	1953	1954	1955	1956
Area I						
Lime-potash mixtures	0	9.9	11.5	12.0	12.0	8.2
Manure salts	.1	2.8	0	0	0	0
Potassium chloride (48–52 percent)	8.3	45.7	2.1	0	0	3.8
Potassium chloride (58–62 percent)	48.6	19.7	75.5	70.4	73.2	76.0
Sulphate of potash-magnesium	0	(2)	(2)	(2)	(2)	(2)
Potassium nitrate	0	1.8	.3	3.0	0	3.1
Potash-phosphate ash	25.6	2.8	2.1	.4	(2)	0
Sodium nitrate-potash	0	0	0	0	0	0
Sulphate of potash	17.4	17.3	8.5	14.2	14.8	8.9
Other	0	(2)	0	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Area II						
Lime-potash mixtures	0	0	0	0	0	0
Manure salts	0	0	0	0	0	0
Potassium chloride (48–52 percent)	31.4	69.9	55.5	23.0	16.5	3.1
Potassium chloride (58–62 percent)	68.2	30.1	44.5	74.6	83.1	96.7
Sulphate of potash-magnesium	.4	0	0	.2	.1	.2
Potassium nitrate	0	0	0	0	0	0
Potash-phosphate ash	0	0	0	2.2	.3	0
Sodium nitrate-potash	0	0	0	0	0	0
Sulphate of potash	0	0	0	0	0	0
Other	0	0	0	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Area III						
Lime-potash mixtures	0	0	0	0	0	0
Manure salts	0	0	0	0	0	0
Potassium chloride (48–52 percent)	.3	6.0	0	0	0	1.0
Potassium chloride (58–62 percent)	0	0	0	64.6	10.5	28.6
Sulphate of potash-magnesium	0	0	6.9	3.1	7.2	11.0
Potassium nitrate	99.0	94.0	93.1	30.8	81.1	54.8
Potash-phosphate ash	0	0	0	1.5	.2	0
Sodium nitrate-potash	.7	0	0	0	0	1.6
Sulphate of potash	0	0	0	0	1.0	3.0
Other	0	0	0	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0

[1] Based on the proportions of total cooperative volume appearing in appendix table 14.

[2] Less than .05 percent.

Appendix Table 10.—Tonnage of primary plant nutrients in all commercial fertilizer used in three areas of the South and the United States, 1951–56

Year ended June 30	Nitrogen tonnage	Available P_2O_5 tonnage	Potash tonnage	Total primary plant nutrient tonnage
Area I	*Thousands*	*Thousands*	*Thousands*	*Thousands*
1951	395	750	499	1,645
1952	446	756	572	1,774
1953	470	735	585	1,791
1954	485	685	600	1,769
1955	498	668	621	1,787
1956	484	649	617	1,750
Area II				
1951	219	224	107	551
1952	241	226	117	584
1953	255	203	119	577
1954	294	193	125	612
1955	308	198	121	626
1956	328	213	132	673
Area III				
1951	54	69	78	200
1952	57	74	78	209
1953	67	77	89	232
1954	73	85	83	240
1955	81	77	95	254
1956	86	85	105	276
South				
1951	668	1,044	684	2,396
1952	745	1,056	767	2,568
1953	791	1,014	793	2,599
1954	852	963	807	2,622
1955	887	943	837	2,667
1956	898	947	853	2,698
United States				
1951	1,171	2,086	1,337	4,595
1952	1,366	2,180	1,545	5,092
1953	1,584	2,251	1,704	5,539
1954	1,790	2,222	1,767	5,779
1955	1,897	2,264	1,834	5,995
1956	1,875	2,228	1,836	5,939

Appendix Table 11.—Units of primary plant nutrients per ton in all commercial fertilizer used in three areas in the South and the United States, 1951–56

Year ended June 30	Nitrogen	Available P_2O_5	K_2O	Total primary plant nutrients
Area I	*Units per ton*	*Units per ton*	*Units per ton*	*Units per ton*
1951	5. 0	9. 6	6. 4	20. 9
1952	5. 5	9. 3	7. 0	21. 8
1953	5. 8	9. 1	7. 3	22. 2
1954	6. 3	8. 8	7. 8	22. 9
1955	6. 6	8. 8	8. 2	23. 6
1956	6. 7	9. 0	8. 6	24. 2
Area II				
1951	9. 7	9. 9	4. 8	24. 4
1952	10. 5	9. 8	5. 1	25. 4
1953	11. 9	9. 5	5. 6	27. 0
1954	13. 8	9. 1	5. 8	28. 7
1955	14. 7	9. 4	5. 8	30. 0
1956	15. 5	10. 0	6. 2	31. 7
Area III				
1951	5. 3	6. 9	7. 8	20. 0
1952	5. 2	6. 8	7. 1	19. 2
1953	5. 8	6. 6	7. 7	20. 1
1954	6. 2	7. 2	7. 0	20. 3
1955	6. 6	6. 3	7. 8	20. 6
1956	6. 4	6. 4	7. 8	20. 6
South				
1951	6. 0	9. 4	6. 2	21. 6
1952	6. 4	9. 2	6. 6	22. 3
1953	7. 0	8. 9	7. 0	22. 9
1954	7. 7	8. 7	7. 3	23. 7
1955	8. 2	8. 7	7. 7	24. 5
1956	8. 4	8. 9	8. 0	25. 3
United States				
1951	5. 7	10. 2	6. 5	22. 4
1952	6. 2	9. 9	7. 0	23. 1
1953	6. 9	9. 8	7. 4	24. 0
1954	8. 0	9. 9	7. 9	25. 8
1955	8. 5	10. 2	8. 2	26. 9
1956	8. 6	10. 2	8. 4	27. 2

Appendix Table 12.—Units of primary plant nutrients per ton in all fertilizers distributed by cooperatives in three areas in the South, 1951–56 [1]

Year ended June 30	Nitrogen	Available P_2O_5	K_2O	Total primary plant nutrients
Area I	*Units per ton*	*Units per ton*	*Units per ton*	*Units per ton*
1951	4. 7	10. 7	7. 3	22. 7
1952	6. 8	11. 3	7. 2	25. 3
1953	8. 1	10. 6	7. 4	26. 1
1954	8. 0	10. 2	8. 4	26. 6
1955	7. 7	10. 2	9. 2	27. 1
1956	7. 4	10. 3	10. 0	27. 7
Area II				
1951	6. 7	8. 9	4. 4	20. 0
1952	11. 7	8. 1	4. 8	24. 6
1953	14. 3	7. 0	5. 2	26. 5
1954	17. 6	6. 6	4. 8	29. 0
1955	18. 7	6. 4	4. 3	29. 4
1956	20. 4	6. 1	4. 4	30. 9
Area III				
1951	9. 7	3. 1	6. 4	19. 2
1952	10. 9	4. 1	5. 3	20. 3
1953	11. 2	3. 1	6. 2	20. 5
1954	10. 5	3. 3	6. 5	20. 3
1955	10. 3	3. 2	7. 1	20. 6
1956	11. 8	3. 3	6. 0	21. 1
South				
1951	5. 8	9. 7	5. 8	21. 3
1952	8. 9	9. 8	6. 2	24. 9
1953	10. 6	9. 0	6. 5	26. 1
1954	11. 8	8. 6	7. 0	27. 4
1955	12. 0	8. 5	7. 3	27. 8
1956	12. 7	8. 4	7. 6	28. 7

[1] Based on those proportions of total cooperative volume appearing in appendix table 14.

Appendix Table 13.—Percentage of primary plant nutrients in all commercial fertilizer supplied in the form of mixtures in three areas of the South and the United States, 1951–56

Year ended June 30	Nitrogen	Available P_2O_5	Potash	Total primary plant nutrients
Area I				
1951	54. 7	79. 5	91. 8	77. 3
1952	52. 4	84. 7	90. 7	79. 5
1953	51. 4	86. 7	91. 7	79. 0
1954	50. 5	90. 5	91. 1	79. 7
1955	49. 2	92. 0	91. 0	79. 7
1956	48. 8	92. 5	90. 7	79. 8
Area II				
1951	25. 5	50. 3	72. 6	44. 8
1952	24. 0	52. 5	72. 5	44. 7
1953	23. 6	57. 2	71. 9	45. 4
1954	21. 7	61. 8	70. 5	44. 3
1955	21. 0	61. 9	71. 5	43. 6
1956	20. 8	61. 8	70. 6	43. 5
Area III				
1951	84. 4	94. 1	92. 6	90. 9
1952	83. 9	94. 5	93. 2	91. 1
1953	83. 2	96. 0	93. 8	91. 5
1954	80. 7	96. 8	95. 6	91. 5
1955	78. 9	96. 8	96. 0	90. 8
1956	79. 8	96. 0	96. 5	91. 1
South				
1951	47. 5	74. 2	88. 9	71. 0
1952	45. 6	78. 5	88. 2	71. 8
1953	45. 1	81. 5	89. 0	72. 7
1954	43. 1	84. 2	88. 4	72. 5
1955	42. 1	86. 1	88. 7	72. 3
1956	41. 6	85. 9	88. 3	71. 9
United States				
1951	46. 5	72. 9	91. 1	71. 5
1952	45. 1	76. 3	89. 9	72. 1
1953	44. 0	78. 5	89. 5	72. 0
1954	41. 6	80. 3	88. 6	70. 9
1955	40. 6	79. 7	88. 7	70. 1
1956	40. 9	79. 4	88. 6	70. 1

Appendix Table 14.—Volume of mixtures and separate materials on which a breakdown was available as a percentage of total cooperative fertilizer volume in the South, year ended June 30, 1951–56

Area	1951	1952	1953	1954	1955	1956
Mixtures:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
I	75. 1	90. 5	90. 9	94. 6	95. 9	93. 3
II	99. 1	99. 2	99. 2	100. 0	100. 0	75. 5
III	12. 9	9. 5	14. 9	15. 9	17. 4	18. 6
South	70. 1	81. 0	81. 5	84. 0	84. 5	77. 9
Separate materials:						
I	93. 9	94. 3	94. 9	96. 9	96. 9	95. 2
II	92. 5	93. 1	92. 7	100. 0	99. 9	99. 8
III	14. 3	21. 2	32. 6	31. 4	32. 6	77. 1
South	90. 2	90. 8	91. 1	95. 9	95. 8	98. 4

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